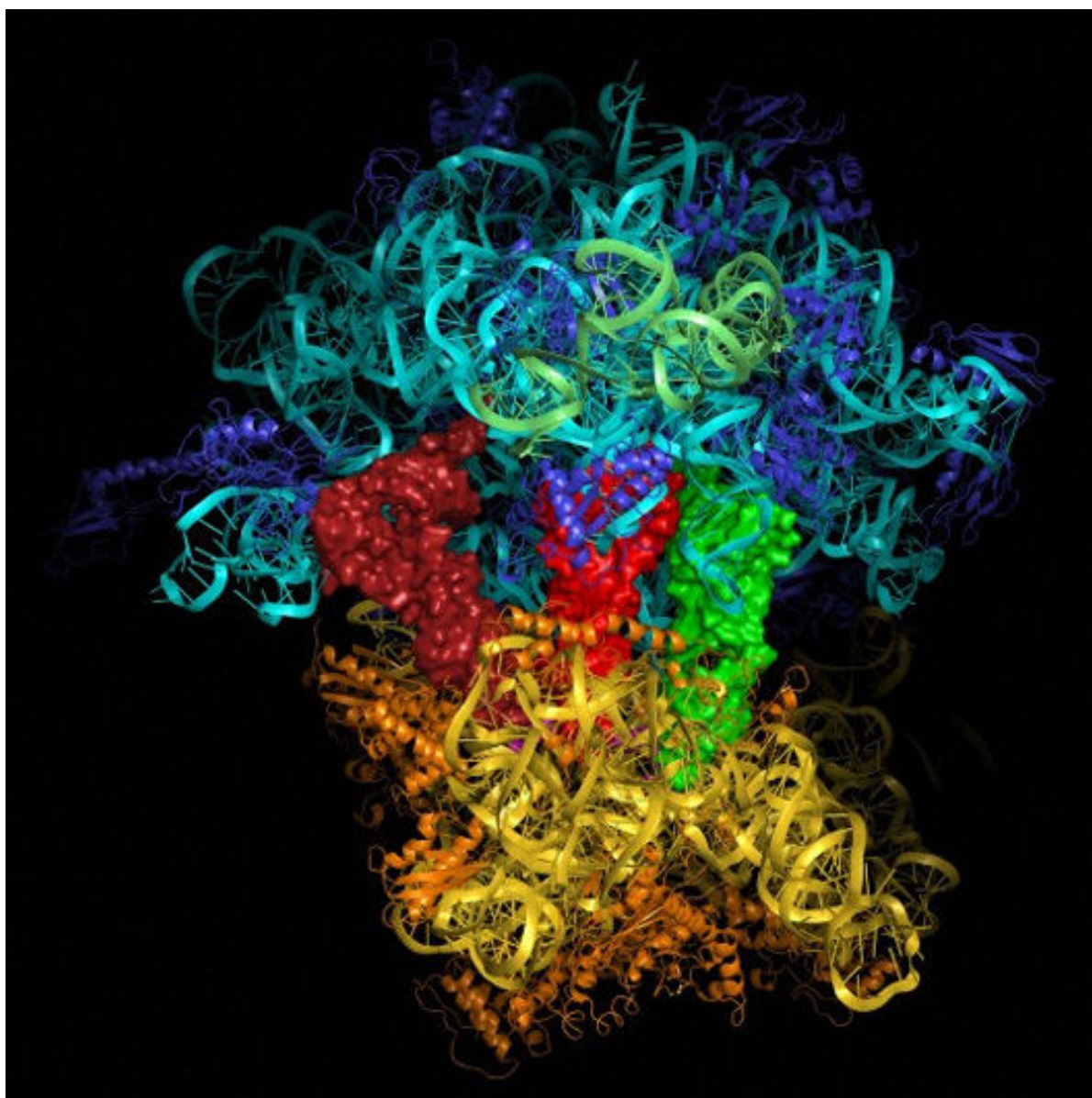


Chapter (1) Chemical basis of life

Lesson (1) Chemical structure of living organisms' bodies (Carbohydrates and Lipids)



We studied before that living organisms' bodies consist of:-

Systems → Organs → Tissues → Cells → Cellular organelles

→ Cells of living organisms consist of organic molecules and inorganic molecules.

→ Organic molecules in living organisms are carbohydrates, lipids, proteins and nucleic acids. They are big molecules containing hydrogen and carbon basically. Such big biological molecules are also known as "Biological macromolecules"

→ Inorganic molecules in living organisms are water and salts, which may contain carbon or not.

Biological macromolecules (polymers)

→ They are huge biological molecules composed of smaller molecules called **monomers**. Biological macromolecules are also called **Polymers**

→ Monomers bind together forming polymers by a **polymerization process**

Carbohydrates

→ They are biological macromolecules which consist of hydrogen, oxygen and carbon. They include sugars, fibres and starches and their general formula is $(CH_2O)_n$ (which means that they consist of carbon, hydrogen and oxygen at ratio 1:2:1 respectively)

The importance of carbohydrates:-

1- The main and quickest source of energy in living organisms

2- They are used in storing energy in living organisms till they need it, as plants store carbohydrates in the form of starch, whereas animals and humans store them in the form of Glycogen in liver and muscles

3- The basic component of some parts of cell such as cellulose in the cell walls of plant cells, protoplasm and cellular membranes

The molecular structure of carbohydrates

Carbohydrates are divided according to their structures into:-

Simple sugars:-

→ A Simple sugar whose polymers consist of only one molecule is called **Monosaccharide** while that which consist of 2 molecules is called **Disaccharides**

Common properties of simple sugars:-

1- Soluble in water

2- They have small molecular weights

3- They have sweet tastes

How to detect simple sugars in food

→ We can detect simple sugars in food by using **Benedict reagent**, simple sugars change its colour from **blue** to **orange**.



Fig. (1) Benedict reagent

Monosaccharides:-

The simplest kind of sugars whose polymer consist of only one molecule

Structure: A molecule composed of a series of carbon atoms, each one of them is bound with an oxygen atom and a carbon one in a certain way.

→ The no. of carbon atoms in a monosaccharide ranges from 3 to 6 atoms

Examples:-

- 1- Glucose (Grapes sugar)
- 2- Fructose (Fruits sugar)
- 3- Ribose

Disaccharides:-

Structure: Two molecules of monosaccharides bound together

Examples:-

- 1- **Sucrose (sugar cane):** It consists of glucose molecule bound with fructose one
- 2- **Lactose (milk sugar):** It consists of glucose molecule bound with Galactose one
- 3- **Maltose (malt sugar):** It consists of two bound glucose molecules

Monosaccharides role in energy transfer processes inside living organisms:-

Living organisms release the energy stored in monosaccharides such as glucose as the following:-

- 1- Glucose is oxidized inside mitochondria in cells
- 2- The energy stored in glucose gets released in the form of chemical bonds

3- The chemical bonds are stored in compounds called Adenosine Triphosphate (ATP)

4- ATP transports to other parts of cell using its stored energy in all the biological processes in cell

Complex sugars (Polysaccharides)

They are carbohydrates which consist of group of monosaccharides, Complex sugars are also called **Polysaccharides**

Common properties of simple sugars:-

- 1- Insoluble in water
- 2- They have heavy molecular weights
- 3- They don't have any taste

Examples:-

- 1- Cellulose
- 2- Starch
- 3- Glycogen

(**N.B:** The polymers of each one of the previous complex sugars consist of glucose molecules bound together)

How to detect starch in substances

Starch changes the colour of **iodine solution** to **blue**

Lipids

→ They are biological macromolecules which are composed of carbon, oxygen and hydrogen. They divided into simple lipids (fats, waxes, oil) , complex lipids (phospholipids) and derivative lipids (steroids)

→ Lipids dissolve in non polar solvents such as **carbon tetrachloride** and **benzene**, but don't dissolve in polar solvents such as **water**

How to detect lipids in substances

→ **Sudan IV reagent** is used to detect lipids, as lipids can dissolve in it changing its colour to **red**

The molecular structure of lipids

- Lipids are formed from 3 fatty acids bound to a glycerol molecule
- glycerol is an alcohol having 3 hydroxyl OH groups

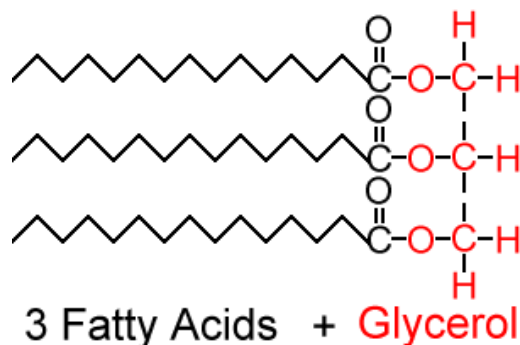


Fig. (2) the structure of lipids

The importance of lipids

- 1- **A source of energy:** The energy released from lipids is more than that released from carbohydrates. Human body begins releasing energy from lipids when it runs out of carbohydrates.
- 2- The main component of cell membranes.
- 3- They make up 5% of the organic compounds forming living cells.
- 4- Some animals (polar bears, penguins, seals) store lipids under their skins to protect them from low temperatures.
- 5- They work as protective layers in some plants and animals.
- 6- Some of them (steroids) work as hormones

The classification of lipids

Simple lipids:-

→ They are formed from the reaction of fatty acids with alcohols, they are classified according to the saturation of fatty acids into oils, fats and waxes.

Oils (Triglycerides)

→ They are liquid lipids formed from the reaction of unsaturated fatty acids with glycerol.

→ Some birds' feathers are covered with oils to protect them from water which disable their movement.

Fats (Glycerides)

→ They are solid lipids formed from the reaction of saturated fatty acids with glycerol.

Waxes

→ They are formed from the reaction of fatty acids with heavy molecular weights with monohydroxy alcohols (alcohols having one hydroxyl OH group).

→ Wax covers the leaves of plants (especially desert plants) to decrease the amount of water they lose by transpiration process.

Definitions of lesson (1)

Biological macromolecules: They are huge organic molecules in living organisms which consist from hydrogen and carbon basically (such as carbohydrates, lipids, proteins and nucleic acids).

Carbohydrates: They are biological macromolecules formed from simple molecules (monosaccharides) which include starches, sugars and fibres. They consist of carbon, hydrogen and oxygen at ratio 1:2:1 respectively.

Benedict reagent: A reagent which is used to detect simple sugars, as these sugars change its colour from blue to orange.

Lipids: They are biological macromolecules formed from carbon, hydrogen and oxygen atoms which include different compounds insoluble in water (but they dissolve in benzene and carbon tetrachloride)

Oils: They are liquid lipids formed from the reaction of unsaturated fatty acids with glycerol and called **Triglycerides**

Fats: They are solid lipids formed from the reaction of saturated fatty acids with glycerol and called **glyceride**

Waxes: They are formed from the reaction of fatty acids with heavy molecular weights with monohydroxy alcohols (alcohols having one hydroxyl OH group)

Sudan IV reagent: A reagent which is used to detect lipids in substances, as they dissolve in it changing its colour to red.

Give reasons for (Rationalize)

1- The importance of carbohydrates

Because they are:-

- The main and quickest source of energy in living organisms
- They are used in storing energy in living organisms till they need it, as plants store carbohydrates in the form of starch, whereas animals and humans store them in the form of Glycogen in liver and muscles
- The basic component of some parts of cell such as cellulose in the cell walls of plant cells, protoplasm and cellular membranes.

2- Benedict reagents can be used to detect simple sugars

Because simple sugars change their colours from blue to orange

3- The importance of lipids

Because they are:-

- source of energy:
- The main component of cell membranes
- They make up 5% of the organic compounds forming living cell
- Some animals store lipids under their skins to protect them from low temperature (polar bears, penguins, seals)
- They work as protective layers in some plants and animals
- Some of them work as hormones (steroids)

4- The biological importance of phospholipids

Because they form the membranes of plant and animal cells

5- Monosaccharides are good sources of energy

Because Monosaccharides (such as glucose) are oxidized inside the mitochondria of cells which releases energy from them in the form of chemical bonds. Then, these chemical bonds are stored inside Adenosine Triphosphate (ATP) which supplies all parts of cell with the energy required for all the cellular biological processes

6- Some birds' feathers are covered with oils

to protect them from water which disable their movement..

7- Waxes cover the leaves of desert plants

To decrease the amount of water lost during transpiration process

8- Steroids play an important role in living organisms

Because some of them work as hormones inside the bodies of living organisms

9- Sudan IV reagents are used to detect lipids

Because lipids dissolve in them changing their colours to red.

Questions on lesson (1)

1- Choose the correct answer

1- are from organic molecules forming living organisms

A- Carbohydrates B- Acids C- Bases D- Salts

2- are from inorganic molecules in living organisms

A- Salts B- Nucleic acids C- Carbohydrates D- Proteins

3- Biological macromolecules whose general formula is $(CH_2O)_n$ are called.....

A- Nucleic acids B- Carbohydrates C- Proteins D- Lipids

4- Carbohydrates are stored in plants in the form of.....

A- Starch B- Oils C- Glycogen D- Alcohols

- 5- Carbohydrates are stored in animals and humans in the form of
- A- Starch B- Oils C- Glycogen D- Alcohols
- 6- Animals and humans store carbohydrates in
- A- Liver B- Kidneys C- Muscles D- A&C
- 7- polymers consist of one molecule
- A- Monosaccharides B- Disaccharides C- Polysaccharides
D- Oligosaccharides
- 8- Polymers consist of two molecules each
- A- Monosaccharides B- Disaccharides C- Polysaccharides
D- Oligosaccharides
- 9- is from monosaccharides.
- A- Sucrose B- Cellulose C- Glucose D- Maltose
- 10- Is from disaccharides
- A- Sucrose B- Fructose C- Cellulose D- Lactose
- 11- starch is from
- A- simple sugars B- complex sugars C- Waxes D- Steroids
- 12- is from complex sugars
- A- Glycogen B- Maltose C- Glucose D- Fructose
- 13- is a disaccharide whose polymer is composed of one glucose molecule and another fructose one
- A- Sucrose B- Cellulose C- Maltose D- Lactose
- 14- is a disaccharide whose polymer is composed of two glucose molecules bound together
- A- Maltose B- Sucrose C- Lactose D- Fructose
- 15- Lactose polymer consists of a glucose molecule bound to one
- A- Fructose B- Galactose C- Lactose D- Glucose
- 16- sugar is found in fruits
- A- Lactose B- Starch C- Glycogen D- Fructose
- 17- forms the cell walls of plant cells
- A- Cellulose B- Starch C- Galactose D- Glucose
- 18- Lipids dissolve in non polar solvents such as...
- A- Carbon tetrachloride B- Water C- Hydrochloric acid
D- Alkaline solutions

19- are liquid lipids formed from the reaction of unsaturated fatty acids with glycerol

A- Oils B- Waxes C- fats D- Proteins

20- are solid lipids formed from the reaction of saturated fatty acids with glycerol

A- Oils B- Waxes C- fats D- Proteins

21- are formed from the reaction of fatty acids with heavy molecular weights with monohydroxy alcohols

A- Oils B- Waxes C- fats D- Proteins

22- are from complex lipids

A- Phospholipids B- Oils C- fats D- waxes

23- Lipids such as work as hormones inside human body

A- Steroids B- Phospholipids C- Oils D- fats

24- is from derivative lipids

A- Cholesterol B- waxes C- oils D- Phospholipids

25- are used to detect simple sugars.

A- Benedict reagents B- Litmus papers C- Iodine solutions

D- Sudan IV reagents.

26- are used to detect lipids.

A- Benedict reagents B- Litmus papers C- Iodine solutions

D- Sudan IV reagents

27- are used to detect starch.

A- Benedict reagents B- Litmus papers C- Iodine solutions

D- Sudan IV reagents

2- Write the scientific term

1- They are huge organic molecules in living organisms which consist from hydrogen and carbon basically (such as carbohydrates, lipids, proteins and nucleic acids)

2- They are biological macromolecules formed from simple molecules (monosaccharides) which include starches, sugars and fibres. They consist of carbon, hydrogen and oxygen at ratio 1:2:1 respectively

3- They are biological macromolecules formed from carbon, hydrogen and oxygen atoms which include different compounds which are insoluble in water (but they dissolve in benzene and carbon tetrachloride)

4- They are liquid lipids formed from the reaction of unsaturated fatty acids with glycerol.

5- They are solid lipids formed from the reaction of saturated fatty acids with glycerol

6- They are formed from the reaction of fatty acids with heavy molecular weights with monohydroxy alcohols (alcohols having one hydroxyl OH group).

3- Write short notes about

1- The importance of carbohydrates

2- The importance of lipids

The Answers - Lesson (1)

1- Choose the correct answer

1- Carbohydrates

2- Salts

3- Carbohydrates

4- Starch

5- Glycogen

6- A&C

7- Monosaccharide

8- Disaccharides

9- Glucose

10- Sucrose

11- complex sugars

12- Glycogen

13- Sucrose

14- Maltose

15- Lactose

16- Fructose

17- Cellulose

18- Carbon tetrachloride

19- Oils

20- Fats

21- Waxes

22- Phospholipids

- 23- *Steroids*
- 24- *Cholesterol*
- 25- *Benedict reagents*
- 26- *Sudan IV reagents*
- 27- *Iodine solutions*

2- Write the scientific term

- 1- *Biological macromolecules*
- 2- *Carbohydrates*
- 3- *Lipids*
- 4- *Oils*
- 5- *Fats*
- 6- *Waxes*

***Lesson (2) Chemical structure of living organisms' bodies
(Proteins and nucleic acids)***



Proteins

→ Proteins form the bodies of all living organisms, they also take part in the biological reactions occurring within living organisms which help them sustain life.

The importance of proteins

- 1 - The basic component of cell membranes
- 2 - They form muscles, fingernails, hair, organs, glands, ligaments and tendons
- 3- They form liquids in human body such as lymph and blood
- 4- They are necessary for human growth
- 5- The main component of chromosomes
- 6- They form enzymes and hormones

→ hooves and horns of animals, and spider webs are formed from proteins

The molecular structure of proteins

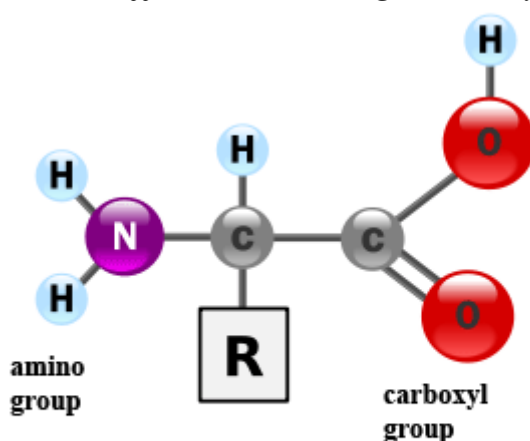
Polymers of proteins are composed of monomers called "**amino acids**"

Amino acids:-

→ The building units of proteins, they are organic compounds which consist of carbon, oxygen, hydrogen and nitrogen atoms.

Structure: An amino acid is composed of a carbon atom linked with:-

- An acidic functional group called amine NH_2
- A basic functional group called carboxyl COOH
- R Group (side group) which differs according to the type of amino acid



General structure of an
 α - amino acid

Fig. (4) The structure of amino acids

Amino acids and building proteins

Proteins are formed from groups of amino acids linked together by **peptide bonds**

Peptide bond: A bond between two molecules which is formed when the carboxyl group of an amino acid reacts with the amine group of another one releasing water molecule (H_2O)

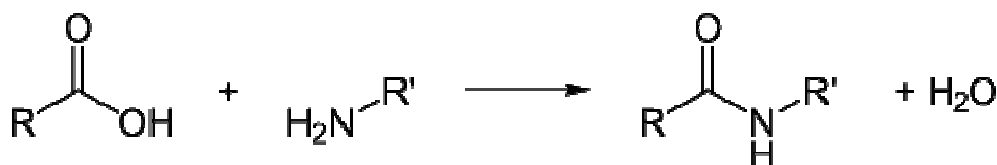


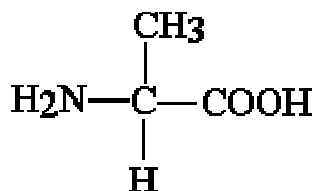
Fig. (5) How peptide bonds form

→ Two amino acids linked by peptide bond are called *Dipeptide*, while a protein chain formed from many amino acids linked by peptide bonds is called *polypeptide*

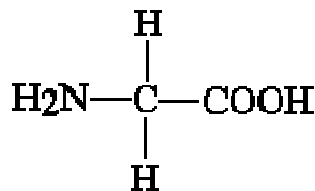
→ Proteins are formed from the same 20 amino acids, but with different arrangements.

Example of amino acids:-

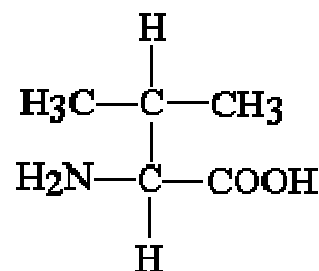
- 1- Alanine
- 2- Glycine
- 3- Valine



alanine



glycine



valine

How to detect proteins in substances

We detect proteins by using **Biuret reagents**, proteins change the colours of these reagents from **blue** to **purple**

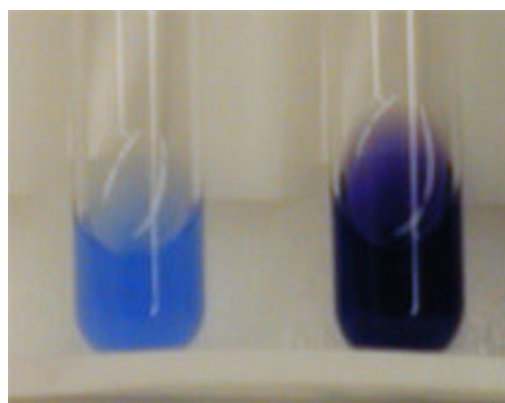


Fig. (6) Biuret reagents

The classification of proteins

Proteins are classified according to their structure into:-

Simple proteins:-

Structure: *They consist of only amino acids*

Examples: *Albumin, which is found in blood plasma, leaves and seeds of plants*

Associated proteins:-

Structure: *They consist of amino acids associated with other elements.*

Examples:-

1- Nuclear-associated proteins:

2- Phosphoproteins: *They contain phosphorus element (ex. Casein – milk protein)*

3- Thyroxin: *Hormone secreted by thyroid gland and contains iodine element.*

4- Blood hemoglobin: *Its protein contains iron element.*

Levels of protein structure

Primary structure of protein:-

It describes the arrangement of amino acids in polypeptides of a certain protein. This level determines the no. , kind and the arrangement of the amino acids forming protein.

Secondary structure of protein:-

It describes the way by which polypeptides are coiled.

This structure is formed due to the hydrogen bonds between carboxyl and amine groups in close amino acid monomers.

Tertiary structure of protein

It describes the three-dimensional shape of proteins.

This structure is formed due to the bonds between the side groups (R groups) of amino acids which bends the different polypeptide chains which gives protein its unique shape.

Quaternary structure of protein

It describes proteins which consist of two or more chains of polypeptide.

This structure is formed due to the linkage of polypeptide chains with each other.

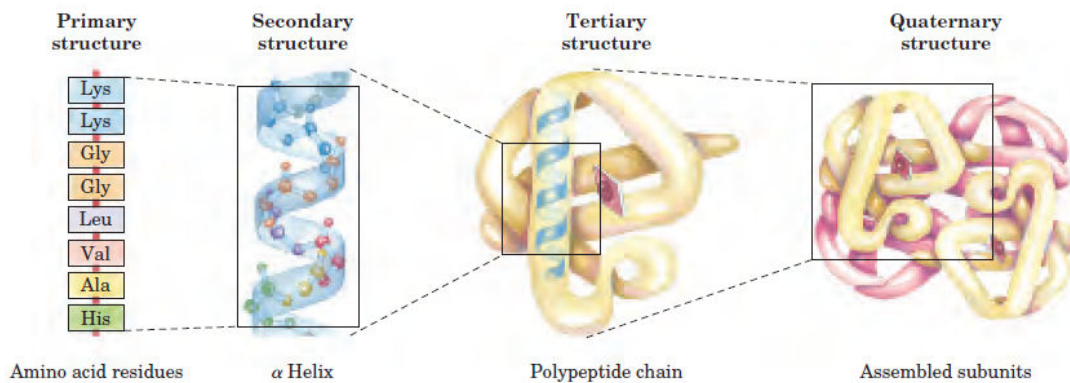


Fig. (7) Levels of protein structure

Nucleic Acids

→ They are biological macromolecules which consist of hydrogen, oxygen, carbon, nitrogen and phosphorus. Nucleic acids have two kinds which are:-

- Ribonucleic acid (RNA)
- Deoxyribonucleic acid (DNA)

→ Nucleic acids consist of structural units called nucleotides which are bound together by covalent bonds forming polynucleotide

Nucleotides:-

→ The building units of nucleic acids, each one of them is composed of three units which are:-

- Pentose (5 carbon) sugar:

There are two types of pentose sugar which form nucleic acids, these types are:-

Ribose: forms RNA

Deoxyribose: forms DNA

- Phosphate group

It's linked by a covalent bond to the carbon atom no. 5 of sugar molecule of the nucleic acid.

- Nitrogenous base

There are five nitrogenous bases which are:-

- Adenine (A)
- Thymine (T) → Replaced by Uracil (U) in RNA molecules
- Cytosine (C)
- Guanine (G)

→ Each of the previous bases link with the 1st carbon atom of sugar molecule in covalent bond.

→ Nucleic acids differ according to their pentose sugars and nitrogenous bases
 → Uracil base in RNA molecule is the equivalent to thymine base in DNA molecule.

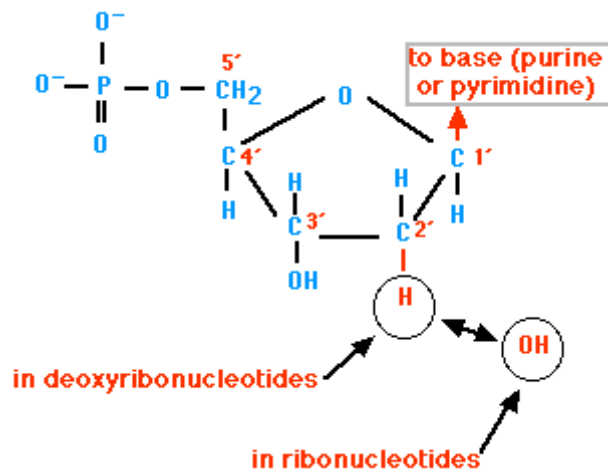


Fig. (8) The structure of a nucleotide

The importance of DNA

- 1- It is from the basic components of chromosomes.
 - 2- It is responsible for transferring hereditary traits through generations.
 - 3- It carries the hereditary information responsible for the characteristics of living organisms and organization of the biological processes within cells.
- DNA molecule consists of two strands coiled around each other.
 → Guanine base binds to Cytosine base with triple hydrogen bond.
 → Thymine base bind to Adenine base with double hydrogen bond

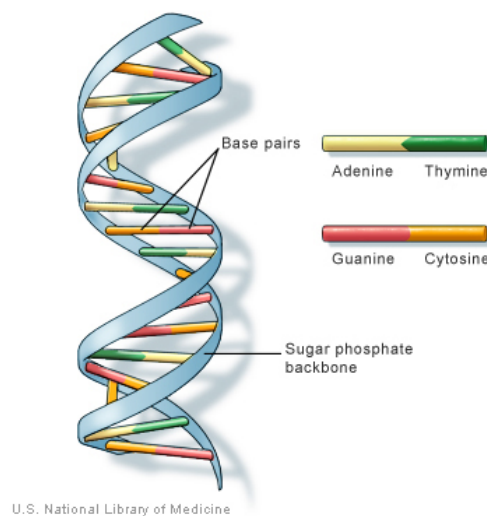


Fig. (9) The structure of DNA molecule

The importance of RNA

→ It copies the information of DNA , then it transports to cytoplasm to be used in making proteins which are responsible for the hereditary traits and organization of biological processes.

→ Guanine base binds to Cytosine base with triple hydrogen bond.

→ Uracil base bind to Adenine base with double hydrogen bond.

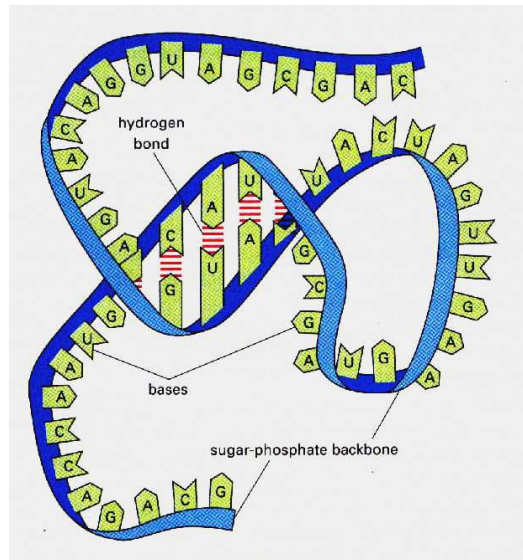


Fig. (9) The structure of RNA molecule

Definitions of lesson (2)

Proteins: They are complex biological macromolecules which consist of oxygen, hydrogen and carbon atoms basically, they have heavy molecular weights, and their structural units (monomer) are amino acids.

Amino acids: The building units of proteins, they are organic compounds which consist of carbon, oxygen, hydrogen and nitrogen atoms.

Peptide bond: A bond between two molecules which is formed when the carboxyl group of an amino acid reacts with the amine group in another one, which releases water molecule (H_2O)

Dipeptide: Two amino acids linked by peptide bond.

Polypeptide: protein chain formed from many amino acids.

Nucleic acids: They are biological macromolecules which consist basically of hydrogen, oxygen, carbon and nitrogen. They are composed of structural units called nucleotides. Nucleic acids divide into RNA and DNA.

1- Proteins play an important role in life.

Because :-

- 1 - They are from the basic component of cell membranes
- 2 - They form muscles, fingernails, hair, organs, glands , ligaments and tendons
- 3- They form liquids in human body such as lymph and blood
- 4- They are necessary for human growth
- 5- The main component of chromosomes
- 6- They form enzymes and hormones

2- The importance of DNA

Because:-

- 1- It is from the basic components of chromosomes.
- 2- It is responsible for transferring hereditary traits through generations.
- 3- It carries the hereditary information responsible for the unique characteristics of living organisms and organization of the biological processes within cells.

3- The importance of RNA

Because it copies the information of DNA , then it transports to cytoplasm to be used in making proteins which are responsible for the hereditary traits and organization of biological processes.

4- The importance of the primary structure of proteins

Because it describes the arrangement of amino acids in polypeptides of a certain protein and determines the no. , the arrangement and kind of the amino acids forming proteins.

5- The importance of the secondary structure of proteins

Because it describes the way by which polypeptides coil around themselves.

6- The importance of the tertiary structure of proteins

Because it describes the three-dimensional shape of proteins.

7- The importance of the quaternary structure of proteins

Because it describes proteins which consist of two or more chains of polypeptide.

8- When albumin protein disassociate, it produces amino acids only.

Because albumin is a simple protein which consists of only amino acids.

9- There are millions of different proteins although they are formed from the same 20 amino acids.

Because proteins structures differ by the difference of the arrangement of the amino acids forming them.

Questions on lesson (2)

1- Choose the correct answer

1- are the basic components of lymph and blood in human body.

A- Proteins B- Carbohydrates C- Lipids D- Nucleic acids

2- Polymers of proteins are composed of monomers called

A- Nucleic acids B- Amino acids C- Citric acids D- Uric acid

3- The acidic functional group forming an amino acid is called.....

A- Amine B- Carboxyl C- Hydroxyl D- Phosphate

4- The basic functional group forming an amino acid is called.....

A- Amine B- Carboxyl C- Hydroxyl D- Phosphate

5- Proteins are formed from groups of amino acids linked together by Bond

A- Ionic B- Hydrogen C- Hydrophobic D- Peptide

6- is from simple proteins.

A- Albumin B- Casein C- Thyroxin D- Hemoglobin

7- is from phosphoproteins.

A- Casein B- Hemoglobin C- Albumin D- Insulin

8- Casein is a protein which contains element

A- Iron B- Iodine C- Phosphorus D- Sulphur

9- Hemoglobin protein contains element

A- Iodine B- Phosphorus C- Sodium D- Iron

10 - Thyroid gland secretes thyroxin hormone, the proteins of thyroxin hormone contain..... element

A- Iodine B- Phosphorus C- Calcium D- Potassium

11- carries the hereditary traits of living organisms.

A- DNA B- RNA C- Amino acid D- Phosphoric acid

12- acid helps in protein synthesis process which cause the appearance of hereditary traits

A- Ribonucleic B- Deoxyribonucleic C- amino D- Sulphuric

2- Write the scientific term

- 1- Biological macromolecules whose monomers are called amino acids.
- 2- A bond between two molecules form when the carboxyl group of an amino acid reacts with the amine group in another one, which releases water molecule (H_2O)
- 3- Two amino acids linked by peptide bond.
- 4- protein chain formed from many amino acids.
- 5- They are composed of structural units called nucleotides.
- 6- A kind of protein found in milk
- 7- Protein which consist of only amino acids.
- 8- Proteins which consist of amino acids associated to other elements.
- 9- Protein found in blood and consists of amino acids bound to iron element
- 10- The building units of nucleic acids
- 11- A kind of pentose which forms the nucleotides of RNA
- 12- A kind of pentose which forms the nucleotides of DNA
- 13- The nucleic acid which is responsible for transferring hereditary traits through generations.
- 14- The nucleic acid which takes part in making proteins which are responsible for the hereditary traits and organization of biological processes.

3- Write short notes about

- 1- Importance of proteins
- 2- Importance of DNA
- 3- Importance of RNA

The Answers - Lesson (2)

1- Choose the correct answer

- 1- Proteins
- 2- Amino acids
- 3- Carboxyl
- 4- Amine
- 5- Peptide
- 6- Albumin
- 7- Casein
- 8- Phosphorus

- 9- Iron
- 10- Iodine
- 11- DNA
- 12- Ribonucleic

2- Write the scientific term

- 1- Proteins
- 2- Peptide bond
- 3- Dipeptide chain
- 4- Polypeptide chain
- 5- Nucleic acids
- 6- Casein proteins
- 7- Simple proteins
- 8- Associated proteins
- 9- Hemoglobin
- 10- Nucleotides
- 11- Ribose
- 12- Deoxyribose
- 13- DNA
- 14- RNA

Lesson (3) Water



→ Water is the basis of life on our planet, it exists in different physical states (solid, liquid, gas). Water makes up:-

→ 70% of the surface of earth

→ (65% - 90%) of the weight of living organisms

The importance of water

It plays an important role in all vital processes within living organisms.

The molecular structure of water

→ water molecule H_2O is composed of one oxygen atom and two hydrogen ones, these atoms are bound covalently (by covalent bond).

→ In water molecule, hydrogen carries molecular negative charge, while oxygen carries molecular positive charge. Thus, water molecule is polar molecule because it has positive and negative poles.

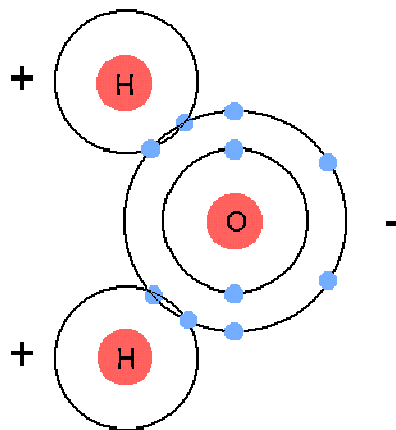


Fig. (10) The molecular structure of water

→ Close water molecules are attracted to each other by relatively low electric attraction (as negative hydrogen atoms attract positive oxygen atoms in another molecules). This bond is called Hydrogen bond

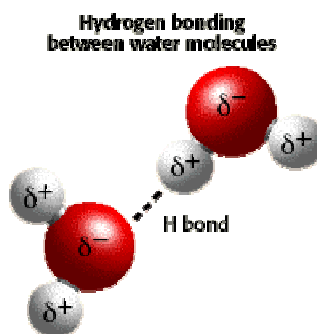


Fig. (11) Hydrogen bond diagram

→ Water has unique properties because of its polarity and hydrogen bonds between its molecules

Water properties

1- Water is a polar solvent

Water is from the best solvents and regarded as "the general solvent" due to the polarity of its molecules

Example:-

When sodium chloride NaCl dissolves in water, it produced positive sodium ions and negative chlorine ions. Thus, positive oxygen atoms of water attract negative chlorine ions, and negative hydrogen atoms attract positive sodium ions.

→ All polar substances (substances containing ions) can dissolve in polar solvents such as water

Importance of this property

→ All the essential substances for living organisms (vitamin, salts, amine acids, gases, glucose) transport inside their bodies in the form of solutes dissolved in water, these substances take part in metabolism reactions inside cells.

2- Water has the ability to ionize molecules which are necessary for life

This means the ability of water to disassociate the molecules necessary for life into positive and negative ions (water can do so due to the polarity of its molecules)

Example:-

→ Pancreas secretes sodium bicarbonate NaHCO_3 , this compound ionizes in water into positive hydrogen ions and negative bicarbonate ones, which makes the medium alkaline and suitable for enzymes work.

Importance of this property

It's essential for the occurrence of some chemical reactions inside living organisms (see the previous example)

3- Water has high specific heat

Specific heat: The amount of heat required to increase the temp. of one gram of matter 1 Celsius degree

Water has the highest specific heat on earth due to the hydrogen bonds of between its molecules

→ As a result of having high specific heat, water needs great amount of energy to increase its temperature and loses great amount of energy when its temperature decreases

The importance of this property

1- It helps living organisms have constant temperature which is essential for the vital processes occurring within their bodies, as cells contain lots of water to keep their temp. constant.

→ Animals and plants lose water by sweating and transpiration processes to decrease their temperature.

2- The high specific heat of water provides living organisms with temperatures suitable for life on earth.

→ Water form almost 70% of the surface area of earth, if water didn't exist with such great amount, the temp. of earth would decrease dramatically because the substances forming the earth crust have low specific heat.

→ Waters of oceans absorb great amount of sunrays in the morning, and spreads them in atmosphere at night to keep the temperature of earth suitable for living organisms

4-Water has low viscosity and high surface tension

Surface tension: The cohesion of the molecules on the surface of a fluid to occupy the least possible volume.

Viscosity: The resistance of fluid to flowing.

→ Water has low viscosity and high surface tension due to the hydrogen bonds between its molecules, these conditions are suitable for life.

Importance of these properties

1- They work on the cohesion of cell substances.

2- Slowing down losing water in plants' leaves through pores.

3- Some insects can walk on water due to the cohesion of the molecules on it surface (water has high surface tension)

5- Water density decreases under 4°C

→ Water expands when its temperature becomes less than 4°C (instead of shrinking) , which decreases its density and makes it float (in frozen lakes, we find ice on their surfaces, while we find liquid water in their bottoms).

→ This property is because of the hydrogen bonds between water molecules.

Importance of this property

→ It enables living organisms to live in oceans and seas, without this property, all oceans and seas will turn into ice. By this property, only the surface of water freezes (which works as an insulator to prevent the rest of water from freezing).

6- The freezing point of water decreases if it has substances dissolved in it

→ This property is very important for living organisms because water in organisms which are exposed to temperatures less than 0°C doesn't freeze because it has some substances dissolved in it.

7- Water can turn into vapour in temperatures lower than boiling point (100°C)

→ Water vapour formed on the surfaces of oceans are carried by convection currents to cold atmosphere layers, which change it into clouds which provide living organisms with rain and water.

8- Water rise in capillary tubes

→ Water has the ability to rise in capillary tubes without being pumped despite of gravity.

Importance

This property helps water transport from trees' roots to all its parts.

Definitions of lesson (3)

Polar molecule: A molecule which has a negative pole (atoms with molecular negative charges) and positive pole (atoms with positive charges).

Hydrogen bond: A bond between molecules containing hydrogen atoms by which negative hydrogen atoms of a molecule attract the positive oxygen atoms of another one.

Specific heat: The amount of heat required to increase the temp. of one gram of matter 1°C degree

Surface tension: The cohesion of the molecules on the surface of a fluid to occupy the least possible volume.

Viscosity: The resistance of fluid to flowing.

Rationalize

1- Water is very important for living organisms

Because it plays an important role in all vital processes within living organisms.

2- Water molecules are polar

Because hydrogen atoms carry molecular negative charges, while oxygen atoms carry molecular positive charges. So water molecules have negative and positive poles.

3- Water has unique properties

Because of its polarity and hydrogen bonds between its molecules.

4- Water is regarded as "the general solvent".

Because so many substances dissolve in it due to the polarity of its molecules

5- Being water a polar solvent is very important to living organisms.

Because all the essential substances for living organisms (vitamin, salts, amine acids, gases, glucose) transport inside their bodies in the form of solutes dissolved in water, and these substances take part in metabolism reactions inside cells.

6- Water has the ability to ionize many molecules.

Because of the polarity of water molecules.

7- The ability of water to ionize many molecules is so important to living organisms.

Because it is essential for the occurrence of some chemical reactions inside living organisms.

8- Water has high specific heat.

Due to the hydrogen bonds between its molecules.

9- High specific heat of water is important to us.

Because:-

1- It helps living organisms have constant temperature which is essential for the vital processes occurring within their bodies, as cells contain lots of water to keep their temp. constant.

2- It provides living organisms with temperatures suitable for life on earth.

10- Waters of oceans absorb great amount of sunrays in the morning, and spreads them in atmosphere at night.

To keep the temperature of earth suitable for living organisms.

11- Water has low viscosity and high surface tension

Due to the hydrogen bonds between its molecules.

12- The low viscosity and high surface tension of water are important to us.

Because They work on the cohesion of cell substances and slowing down losing water in plants' leaves

13- Some insects can walk on water.

Due to the cohesion of the molecules on water surface, as water has high surface tension.

14- Water expands and its density decreases when its temperature becomes less than 4°C

Due to the hydrogen bonds between its molecules.

15- Water expansion at temp. less than 4°C is important to living organisms.

Because it enables living organisms to live in oceans and seas, as only the surface of water freezes (which works as an insulator to prevent the rest of water from freezing)

16- The property of the decrease of the freezing point of water which contains solutes is very important to living organisms.

Because water in organisms which are exposed to temperatures less than 0°C doesn't freeze because it has substances dissolved in it.

17- The property of the vaporization of water at temperatures less than boiling points is very important to us.

Because water vapour which is formed on the surfaces of oceans are carried by convection currents to cold atmosphere layers, which change it into cloud which provide living organisms with rain and water.

18- The rise of water in capillary tubes is very important for plants and trees.

Because this property helps water transport from plants roots to all its parts.

Questions on lesson (3)

1- Choose the correct answer

1- Close water molecules are attracted to each other by relatively low electric attraction called bond.

A- Hydrogen B- Ionic C- Covalent D- Peptide

2- The amount of heat required to increase the temp. of one gram of matter 1 Celsius degree is called

A- Latent heat B- Specific heat C- Heat amount D- Work

3- Plants lose water by process to decrease their temperature.

A- Sweating B- Transpiration C- Respiration D- Excretion

4- Animals lose water to decrease their temperatures in the form of.....

A- Lymph B- Blood C- Sweat D- Juices

5- When the temp. of water becomes less than 4°C,

A- it expands B- it shrinks C- it doesn't change D- its density increases

6- When substances dissolve in water,.....

A- its freezing point decreases

B- its freezing point increases

C- its boiling point decreases

D- Neither boiling point nor freezing point changes

2- Write the scientific term

1- A molecule which has a negative pole (atoms with molecular negative charges) and positive pole (atoms with positive charges).

2- A bond between molecules containing hydrogen atoms by which negative hydrogen atoms of a molecule attract the positive oxygen atoms of another one

3- The amount of heat required to increase the temp. of one gram of matter 1 Celsius degree

4- The cohesion of the molecules on the surface of a fluid to occupy the least possible volume

3- Write short notes about

1- Water polarity

2- Water rise in capillary tubes

The Answers - Lesson (3)

1- Choose the correct answer

1- Hydrogen

4- Sweat

2- Specific heat

5- it expands

3- Transpiration

6- its freezing point decreases

2- Write the scientific term

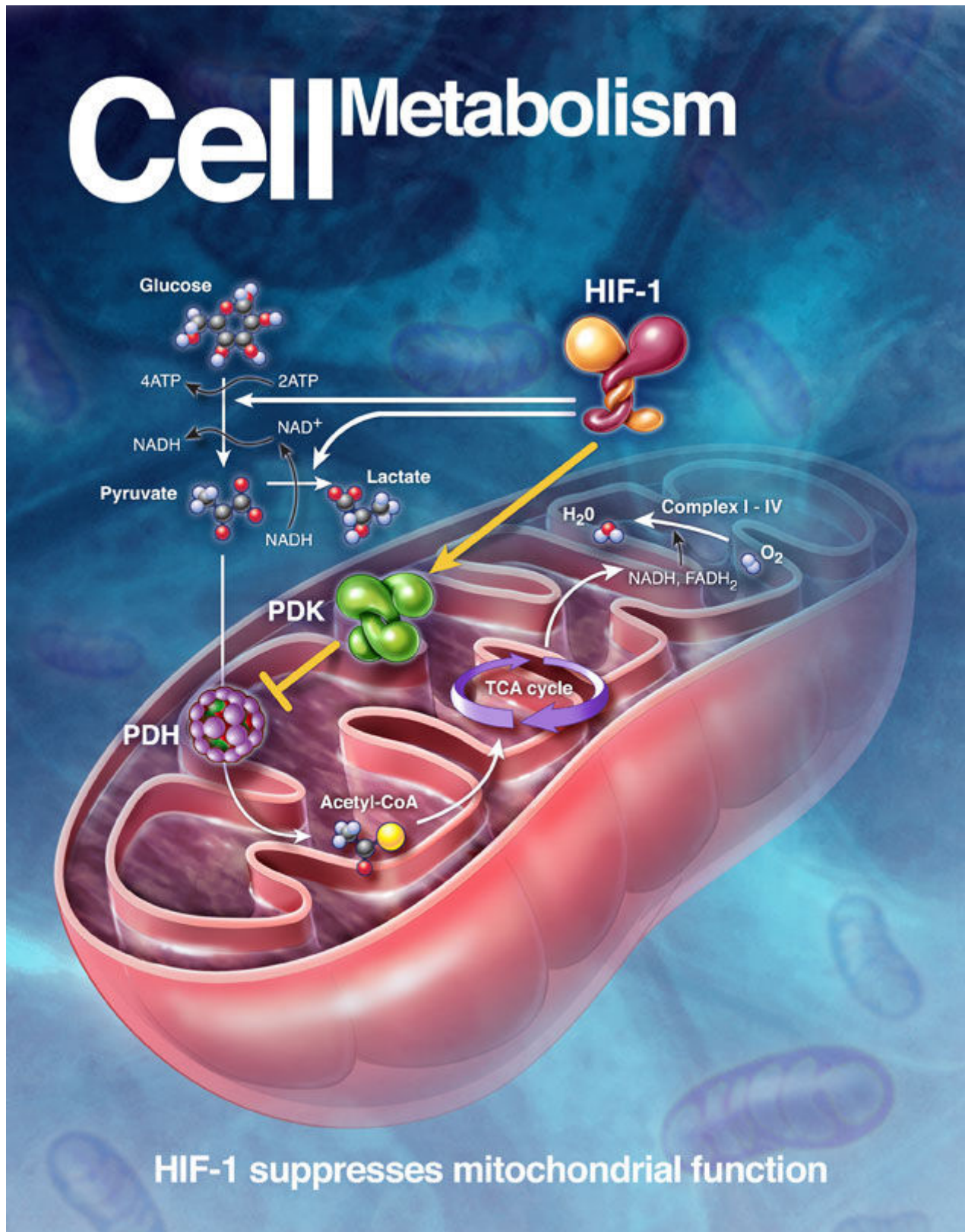
1- Polar molecule

2- Hydrogen bonds

3- Specific heat

4- Surface tension

Lesson (4) Chemical reactions inside organisms' bodies



*Biological chemical reactions occur inside living organisms body in order to help in growth, get energy, build tissues and sustain life. These reactions are called "**Metabolism**". If these reactions stop in a living organism, it will die.*

Metabolism: *A group of biochemical reactions which occur within living organisms in order to build complex macromolecules from simple molecules, or break up molecules to get energy.*

Metabolism reactions are divided into:-

1- Anabolism

2- Catabolism

Anabolism: *A process by which simple molecules are used to build complex macromolecules through a group of chemical reactions which consume energy.*

→ Building proteins from amino acids is an example on anabolism

Catabolism: *A process by which energy is being released from the chemical bonds in some molecules such as glucose.*

→ Cells break up glucose to release energy from it.

Enzymes

→ Chemical reactions generally need high activation energy to occur. To decrease the energy used by cell in biochemical reactions occurring inside it, we need catalysts to decrease activation energy needed for the reaction to occur, which speeds this reaction up. Such catalysts are called enzymes

Activation energy: *The minimum energy required for a chemical reaction to occur.*

(For reading only): The term activation energy was coined by Swedish scientist Arrhenius in 1889 A.D.

Enzymes: *Biological catalysts formed from proteins molecules which speed up chemical reactions occurring within living organisms.*

Enzymes are formed from groups of amino acids which are arranged in the form of polypeptide chains which forms the stereoisomerism of enzymes.

(For illustration) stereoisomer: Molecules that have the same no. of atoms but with different arrangements.

The properties of enzymes

- 1- They resemble chemical catalysts, as they only speed up the chemical reaction without taking part in it.
- 2- Enzymes are affected by the concentration of hydrogen ions (pH) and temperature.
- 3- Enzymes are different from other catalysts because every enzyme is specialized for only one reactant substance (**called substrate**) and a small no. of reactions.
- 4- Enzymes decrease the activation energy needed for chemical reactions to occur.

Substrate: The substance on which enzyme work.

The chemical structure of enzymes

Enzymes are classified according to their chemical structure into:-

1- Simple enzymes

They are enzymes which are composed of simple proteins.

Example: Amylase enzyme.

(For reading only) amylase is an enzyme secreted by salivary glands, which changes starch into sugar.

2- Complex enzymes

They are enzymes which consist of:-

1- Protein part

2- Non protein part: This part may be an atom of metal (iron, copper, magnesium) or an organic molecular called coenzyme, non protein part is the active site of enzyme molecule.

Example: Catalase enzyme

(For reading only) catalase enzymes speeds up the decomposition of hydrogen peroxide H_2O_2 into water and oxygen

The active site of enzyme

Every enzyme has one or more active sites

Active site: A stereoisomer which is responsible for enzyme work

Mechanism of enzyme

- 1- The active site of an enzyme (E) links with the substrate (S) forming enzyme-substrate complex (ES).

2- The complex decomposes, products of reaction are formed and the enzyme gets released.

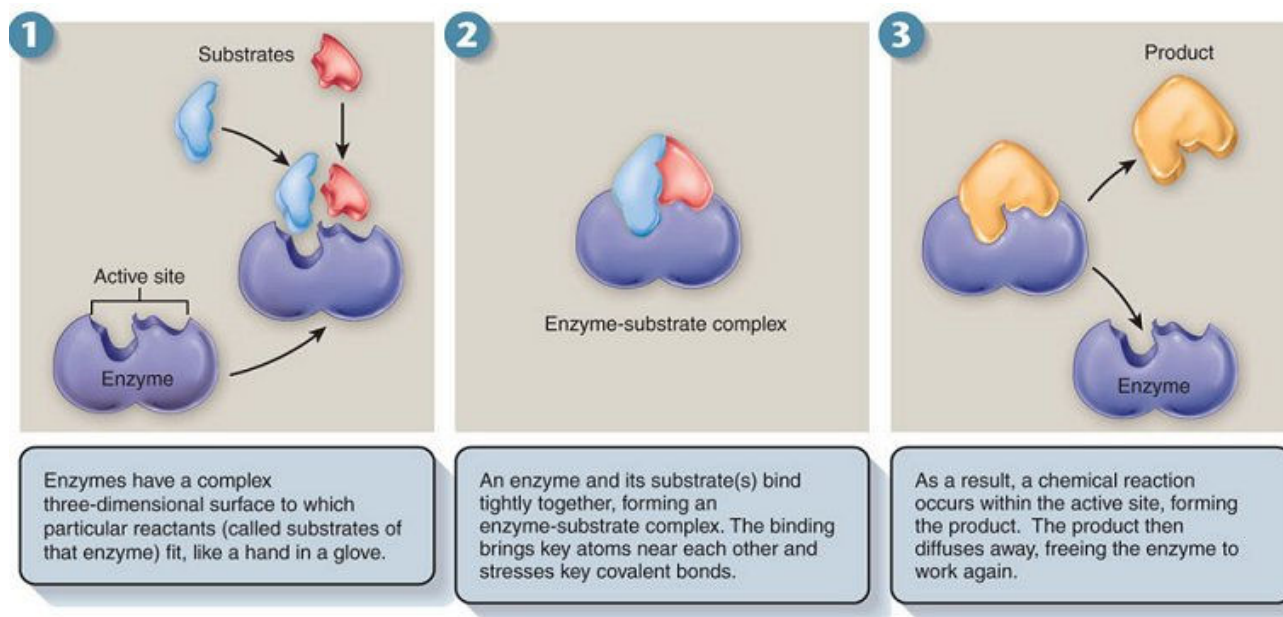


Fig. (12) The mechanism of enzyme

Factors affecting the work of enzymes

1- Temperature

Every enzyme has a different optimum temperature (the temperature on which the enzyme becomes most active).

→ When the temp. of an enzyme increases more than its optimum temperature, its activity decreases gradually until it stops due to the change of its structure.

→ When the temp. of an enzyme becomes less than its optimum temperature, its activity also decreases gradually. Enzyme activity stops at 0°C (but it become active again when its temperature increases).

2- Power of hydrogen (pH)

It's the measurement which determines the concentration of hydrogen ions H^+ in a solution, and determines if the solution is acidic, alkaline or neutral.

Solutions with pH less than 7 are acidic, while those with pH more than 7 are alkaline. Solutions with pH equals 7 are neutral.

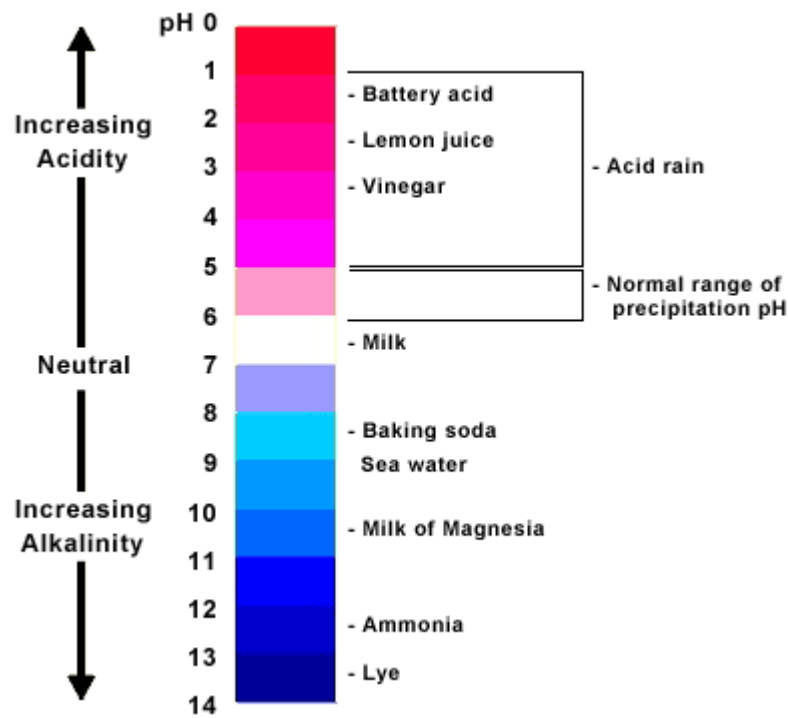


Fig. (12) pH measurement

→ Indicators of pH has standard colours to determine the acidity or basicity of a solution and gives approximated numbers, while the digital devices give more accurate numbers.

Example of pH indicators:-

- 1- Litmus papers
- 2- Methyl orange
- 3- Phenolphthalein

pH and the activity of enzymes

→ Enzymes are affected by pH because its composed of amino acids which contain acidic carboxyl groups COOH- and basic amine groups NH_2 .

→ Each enzyme has its own pH on which it becomes most active, this degree of pH is called "**Optimum pH**"

→ If the pH of an enzyme decreased or increases, its activity decreases gradually till it stops.

→ Most enzymes works at pH of 7.4

Examples

- Pepsin enzyme works at acidic pH (less than 7)
- Trypsin enzyme works at basic pH (more than 7)

(For reading only) pepsin enzyme is secreted by stomach to help in the digestion of proteins, whereas trypsin enzyme is secreted by pancreas and poured in small intestine to digest proteins, too.

Nanopharmaceuticals

→ Scientists discovered that proteins can be used in the treatment of many diseases and disorders in human body. These biological macromolecules were produced and used to treat some diseases, they are called **Biopharmaceuticals**

→ It's hard to send medicines to target cells in human body, scientists solved this problems by discovering methods to send these medicines to target cells by using nanomaterials, which resulted in the creation of a new science called **Nanopharmaceutics** and these nano biological medicines were called **Nanobiopharmaceutics**

Definitions on lesson (4)

Metabolism: A group of biochemical reactions which occur within living organisms in order to build complex macromolecules from simple molecules, or break up molecules to get energy.

Anabolism: A process by which simple molecules are used to build complex macromolecules through a group of chemical reactions which consume energy.

Catabolism: A process which breaks some molecules to release energy from them.

Activation energy: The minimum energy required for a chemical reaction to occur.

Enzymes: Biological catalysts formed from proteins molecules which speed up chemical reactions occurring within living organisms.

Substrate: The substance on which enzyme work.

Active site: A stereoisomer which is responsible for enzyme work.

Power of hydrogen pH: The measurement of the concentration of positive hydrogen ions in solutions to determine their acidity or basicity.

Biopharmaceuticals: They are biological macromolecules which are used to treat some diseases.

Nanopharmaceutics: The science that studies and creates methods for sending medicine right to target cells accurately by means of nanomaterials.

Nanopharmaceuticals: They are biological macromolecules which are used as medicines to treat some diseases, they are being sent to target cells by means of nanomaterials..

Give reasons for

1- Metabolism reactions are very important to living organisms.

Because it plays an important role in building complex molecules from simple ones, and breaking some molecules to release the energy stored in them.

2- Catabolism and Anabolism reactions are essential for living cells.

Because catabolism process breaks up some molecules to release the energy stored in them, while anabolism builds up complex molecules from simple ones.

3- The biological importance of enzymes.

Because they speed up chemical reactions occurring inside living organisms without taking part in them by decreasing the activation energy needed for these reactions to occur.

4- Amylase is a simple enzyme, while Catalase is a complex one.

Amylase is a simple enzyme because it is composed of simple proteins, while Catalase is a complex enzyme because it is composed of complex proteins and non proteins parts.

5- Temperature affects enzyme activity.

Because each enzyme has a temp. on which it becomes most active "optimum temperature", when its temp. increases or decreases, its activity decreases until it stops

6- When the temp. of an enzyme increases more than its optimum temperature, its activity decreases gradually until it stops.

Due to the change of the natural structure of enzyme.

7- pH of solutions affect enzyme activity.

because its composed of amino acids which contain acidic carboxyl groups COOH- and basic amine groups NH_2 .

Questions on lesson (4)

1- Choose the correct answer

1- A process by which simple molecules are used to build complex macromolecules through a group of chemical reactions which consume energy is called

A- Catabolism B- Anabolism C- Oxidation D- Hydrolysis

2- A process which breaks some molecules to release energy from them is called

A- Oxidation B- Reduction C- Anabolism D- Catabolism

3- The substance on which enzyme work is called

A- Substrate B- Substance of reaction C- Reagent D- Product

4- Enzymes are made up of

A- Proteins B- Nucleic acids C- Carbohydrates D- Lipids

5- is from simple enzymes

A- Amylase B- Catalase C- Pepsin D- Trypsine

6- is from complex enzymes.

A- Trypsine B- Pepsin C- Catalase D- Amylase

2- Define:-

1- Metabolism

2- Anabolism

3- Catabolism

4- Activation energy

5- Enzymes

6- Substrate

7- Active site

8- Power of hydrogen pH

9- Biopharmaceuticals

10- Nanopharmaceutics

11- Nanopharmaceuticals

The Answers - Lesson (4)

1- Choose the correct answer

1- Anabolism

- 2- Catabolism
- 3- Substrate
- 4- Proteins
- 5- Amylase
- 6- Catalase

Test on chapter (1)

Answer only four questions

Questions (1)

(A) Choose the correct answer

- 1- is from monosaccharides.
A- Sucrose B- Cellulose C- Glucose D- Maltose
- 2- is a disaccharide whose polymer is composed of one glucose molecule and another fructose one
A- Sucrose B- Cellulose C- Maltose D- Lactose
- 3- is from phosphoproteins.
A- Casein B- Hemoglobin C- Albumin D- Insulin

(B) What happens if:-

- 1- Water didn't have high specific heat.
- 2- The temp. of an enzyme becomes zero.
- 3- Water didn't have high viscosity.

(C) Show the structures of the following

- 1- Amino acid
- 2- Complex enzyme
- 5- Nucleotide.

Question (2)

(A) What's meant by:-

- 1- Carbohydrates.
- 2- Enzymes
- 3- Anabolism

(B) Correct the underlines words

- 1- Animals store energy in the form of starch
- 2- Amylase is form complex enzymes.
- 3- Amino acids form biological macromolecules called lipids

4- Oils are lipids which form hormones inside human body.

(C) Give reasons for:-

- 1- The biological importance of enzymes.
- 2- Water has low viscosity and high surface tension.
- 3- Waxes cover the leaves of desert plants.

Question (3)

(A) Write the scientific term

- 1- Biological macromolecules whose general formula is $(CH_2O)_n$
- 2- The cohesion of molecules of the surface of a fluid such as water
- 3- Nucleic acids which take part in protein synthesis processes by copying genetic information.
- 4- A process by which molecules are broken inside cells to release energy.
- 5- A complex sugar which forms the cell walls of plant cells.

(B) What is the importance of

- 1- Carbohydrates
- 2- Proteins

(C) Draw a diagram of :-

Nucleotide.

Question (4)

(A) Write a short note about nanobiopharmaceuticals

(B) Mention the kind of the following organic compounds

- 1- Cellulose
- 2- Amylase
- 3- Casein
- 4- Steroids

(C) Draw a diagram of:-

Amino acid

Question (5)

(A) Choose the correct answer

- 1- The amount of heat required to increase the temp. of one gram of matter 1 Celsius degree is called

A- Latent heat B- Specific heat C- Heat amount D- Work

2- Thyroid gland secretes thyroxin hormone, the protein of thyroxin hormone contains..... element

A- Iodine B- Phosphorus C- Calcium D- Potassium

3- carries the hereditary traits of living organisms.

A- DNA B- RNA C- Amino acid D- Phosphoric acid

(B) Write the scientific term

1- The resistance of a fluid to flowing.

2- A stereoisomer which is responsible for enzyme work

3- A kind of protein found in milk.

(C) Rationalize:-

1- Water has unique properties.

2- The biological importance of lipids.

3- pH of solution affects enzymes work

The Answers - Test of chapter (1)

Question (1)

(A) Choose the correct answer

1- Glucose

2- Sucrose

3- Casein

(B) What happens if:-

1- living organisms won't have constant temperature which is essential for the vital processes occurring within their bodies. The temperature of earth won't be suitable for life, which will cause the death of organisms on earth.

2- The activity of enzyme will stop.

3- The substances forming cells won't be held together, and plants' leaves will lose water quickly.

(C) Show the structure of

1- Molecules consist of basic carboxyl groups COOH- , acidic amine groups NH_2 and side group (R).

2- It consists of complex proteins bound to non proteins parts (**Active site**), these parts may be inorganic metal atoms, or organic molecules called coenzymes.

3- It consists of pentose sugar (Ribose in RNA and Deoxyribose in DNA), phosphate group, and nitrogenous base Adenine (A), Thymine (T), Cytosine (C), Guanine (G) and Uracil (U)

Question (2)

(A) What's meant by:-

1- They are biological macromolecules formed from simple molecules (monosaccharides) which include starches, sugars and fibres. They consist of carbon, hydrogen and oxygen at ratio 1:2:1 respectively.

2- Biological catalysts formed from proteins molecules which speed up chemical reactions occurring within living organisms.

3- It builds complex molecules from simple one through a group of biochemical reactions within living cells.

(B) correct the underline words

1- Glycogen

2- Catalase

3- Proteins

4- Steroids

(C) Give reasons for

1- Because they play an important role in building complex molecules from simple ones, and breaking some molecules to release the energy stored in them.

2- Due to the hydrogen bonds between water molecules.

3- To decrease the amount of water lost during transpiration process.

Question (3)

(A) Write the scientific term

1- Carbohydrates.

2- Surface tension

3- RNA

4- Catabolism

5- Cellulose

(B) What is the importance of:-

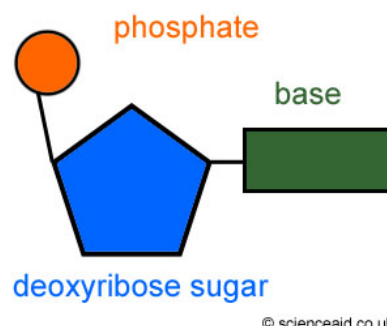
Carbohydrates

- 1- The main and quickest source of energy in living organisms
- 2- They are used in storing energy in living organisms till they need it, as plants store carbohydrates in the form of starch, whereas animals and humans store them in the form of Glycogen in liver and muscles
- 3- The basic component of some parts of cell such as cellulose in the cell walls of plant cells, protoplasm and cellular membranes

Proteins

- 1 - They are from the basic component of cell membranes
- 2 - They form muscles, fingernails, hair, organs, glands , ligaments and tendons
- 3- They form liquids in human body such as lymph and blood
- 4- They are necessary for human growth
- 5- The main component of chromosomes
- 6- They form enzymes and hormones

(C) Draw a diagram of nucleotide



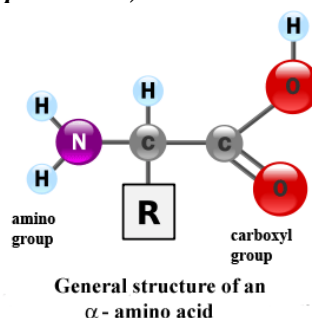
Question (4)

(A) See page 42

(B) Mention the kind:-

- 1- Complex sugar (Carbohydrates)
- 2- Simple enzyme
- 3- Associated protein (Phosphoprotein)
- 4- Derivative lipids

(C) Amino acid



Question (5)

(A) Choose the correct answer

- 1- Specific heat
- 2- Iodine
- 3- DNA

(B) Write the scientific term

- 1- Viscosity
- 2- Active site
- 3- Casein protein

(C) Rationalize

1- Because of its polarity and the hydrogen bonds between its molecules.

2- Because they are:-

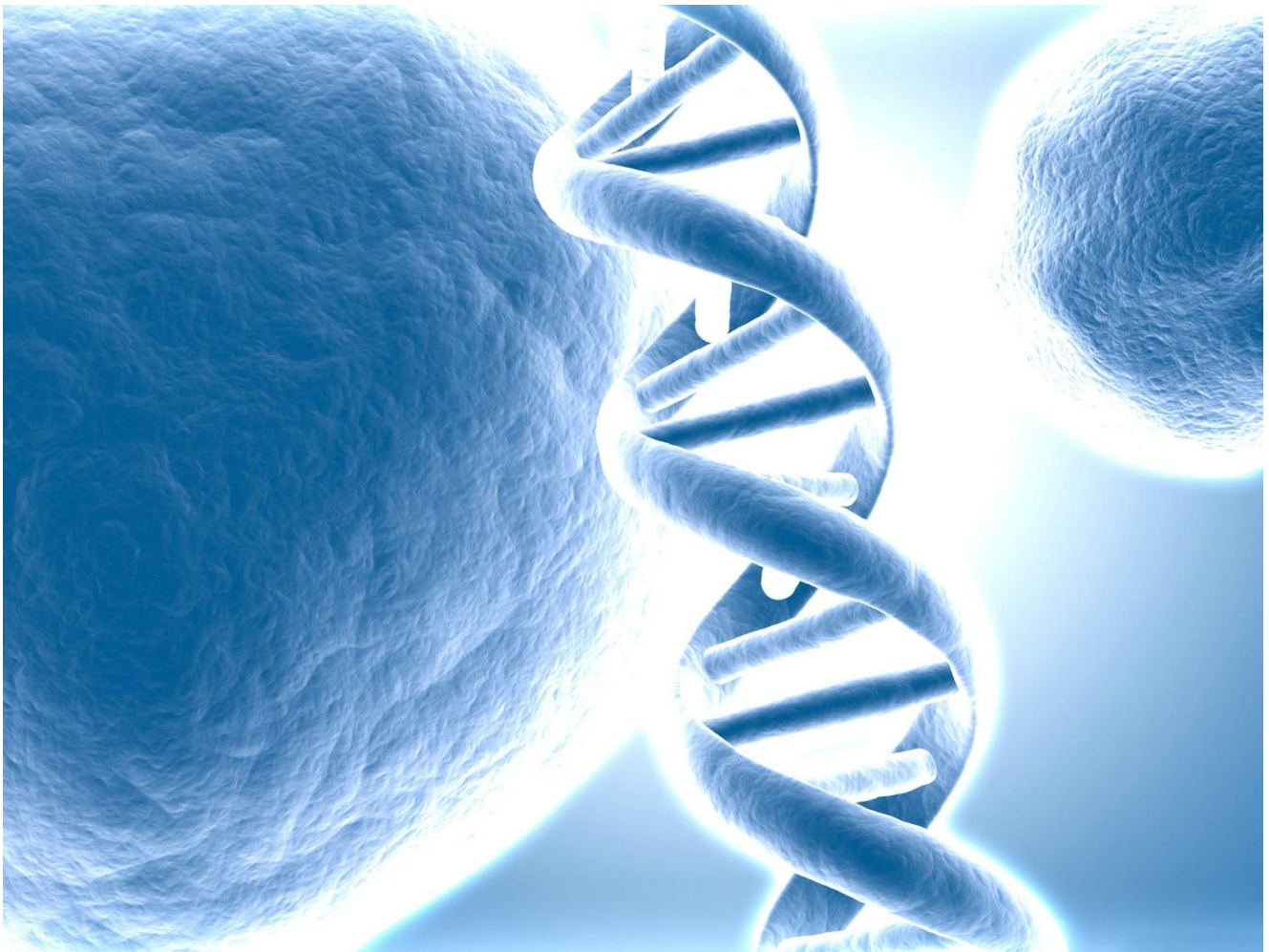
- A source of energy: The energy released from lipids is more than that released from carbohydrates. Thus, human body begins releasing energy from lipids when it runs out of carbohydrates

- The main component of cell membranes
- They make up 5% of the organic compounds forming living cell
- Some animals store lipids under their skins to protect them from low temperature (polar bears, penguins, seals)
- They work as protective layers in some plants and animals
- Some of them work as hormones (steroids)

3- Because enzymes are formed from amino acids which contain acidic amine groups and basic carboxyl groups.

Chapter (2) Cell: structure and function

Lesson (1) Cell theory



Cell: *The building unit of living organisms which can carry out all vital processes.*

Diversity of cells

Cells have different shapes which are suitable for their functions, for example:-

Nerve cells (neurons):-

Neurons are long to be able to send messages from the spinal cord (in the vertebral column) to all body parts.

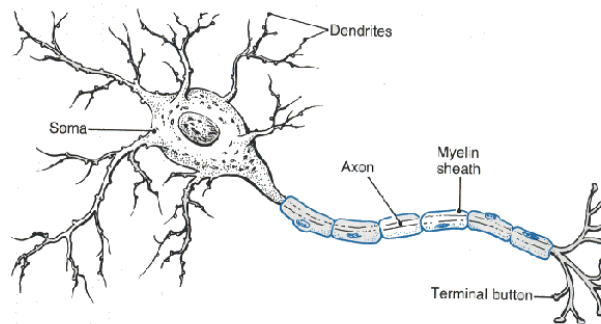


Fig. (1) Neuron

Muscle cells:-

They are long cells with cylinder shape which form muscle tissues. They have the ability to contract and relax to be able to move.

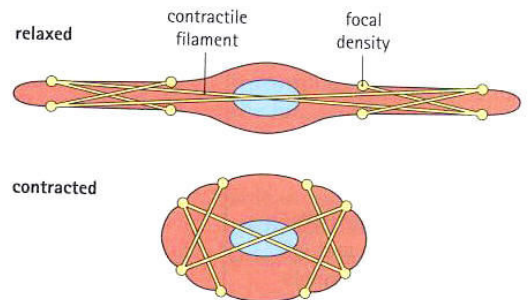


Fig. (2) Muscle cell

Cell theory

Scientists who took part in cell discovery:-

Robert Hooke

An English scientist who discovered cell. He invented a simple microscope in 1665 and examined a piece of cork using it. He concluded that it consists of a number of tiny vacuoles. He named these vacuoles "Cells"

→ The word "Cell" is derived from the Latin word "Cellula" which means "Vacuole or small chamber"

Antoine Van Leeuwenhoek

A Dutch scientist who worked as an employee in the government. He was fascinated about lenses. In 1674, he used these lenses to make a simple microscope of magnification power 200x.

This microscope was used to examine blood, lakes water and other things. Therefore, Leeuwenhoek was the first to see the world of living cells and microorganisms.

Mathias Shleiden

A German scientist who discovered in 1838 that all plants consist of cells.

Theodor Schwann

A German scientist who discovered in 1839 that all animals consist of cells.

Rudolf Virchow

A German physician who stated in 1855 that:-

- Cell is not only the building unit of living organisms, but only the functional unit of them.
- Cells are produced only from cells that existed before them.

The efforts of those scientists formed the so-called "**Cell theory**" which is one of the most important theories in modern life science.

Cell theory has three laws, which are:-

- 1- All living organisms are composed of one or more cells. (See Shleiden and Schwann)
- 2- The cell is the basic unit of structure, function, and organization in all organisms. (See Rudolf Virchow)
- 3- All cells come from pre-existing living cells (See Rudolf Virchow)

Evolution of microscopes

Light microscope

It was the only method available for scientists till 1950.

Properties of light microscope

- 1- It depends on light (sunlight, artificial light)

2- It can magnify things by cutting them to thin slices which allow light to penetrate them.

3- It can magnify things up to 1500 times according to the magnification power of the eyepiece and objective lenses in it. They cannot magnify more than 1500 times because this makes the photo unclear.

The magnification power of light microscope = Magnification power of eyepiece x magnification power of objective lens

Scientists discovered better ways to observe samples clearly by increasing the differentiation between the parts of the sample

These are two of the methods of increasing the differentiation between parts of samples:-

1- Dyeing certain parts of the sample to become clearer as what happens when examining white blood cells.

Disadvantages of method: Dyes kill living samples.

2- Changing the level of lighting



Fig. (3) Light microscope

Electronic microscope

Scientists began using electronic microscopes in 1950.

How does an electronic microscope work

A beam of electrons with great speed is used instead of light. These electrons are controlled by electromagnetic lenses. This microscope has a magnification power of 1,000,000x (one million).

Importance

It helped scientist discover unknown cellular organelles and more accurate details about unknown structures.

→ *Electronic microscope is better than light microscope because:-*

- it gives clearer magnified photos with high differentiation due to the short wave length of electronic beams.*
- It receives the magnified photos of bodies on fluorescent screen or very sensitive photo screen.*



Fig. (4) Electronic microscope

Kinds of electronic microscopes

1- Scanning electronic microscope: *Used to study the cell surface*

2- Transmission electronic microscope: *Used to study the internal structure of cell.*

Definitions of lesson (1)

Cell: The building unit of living organisms which can carries out all vital processes inside living organisms.

Cell theory: A theory which states that all living organisms consist of one or more cells, cell is the basic functional and structural unit of living organisms, and that cells are produced for pre-existing ones.

Light microscope: A microscope which works by artificial light and sunlight with magnification power of 1500x.

Electronic microscope: A microscope which works by beams of electrons controlled by electromagnetic lenses instead of light, it has magnification power of 1,000,000x.

Give reasons for

1- Robert Hooke contributed in the discovery of cell.

Because he examined a piece of cork using a simple microscope and discovered that it consists of vacuoles called cells.

2- Antoine Van Leeuwenhoek is called the father of microscopy.

Because he invented a microscope in 1674 which could magnify samples up to

3- The theories of scientists Schleiden and Schwann are the basis of cell theory.

Because Schleiden stated that all plants consist of cells in 1838, and Schwann proved the same to animals in 1839.

4- Physician Rudolf Virchow was among those who formulated cell theory.

Because he proved that is the building and functional unit of living organisms, and that cells are produced from pre-existing ones.

5- The importance of light microscope.

Because it has the ability to magnify things up to 1500 times, which helped scientists examine cells

6- The importance of electronic microscope.

Because it has the ability to magnify things up to 1,000,000 times clearly, and give magnified photos of bodies on fluorescent screen.

Questions

1- Choose the correct answer

- 1- Scientist gave the name cells to cork vacuoles
A- Robert Brown B- Rudolf Virchow C- Robert Hooke D- Leeuwenhoek
- 2- Scientist invented a microscope that has magnification power of 200x
A- Leeuwenhoek B- Mathias Schleiden C- Theodor Schwann D- Virchow
- 3- Scientist stated that cells are produced from pre-existing ones.
A- Schleiden B- Virchow C- Robert Brown D- Charles Darwin
- 4- microscope has magnification power of 1500x
A- Electronic B- Light C- Stereo D- Digital
- 5- microscope works by sunlight and artificial light.
A- Electronic B- Light C- Stereo D- Digital

2- Complete

- 1- Scientist coined the term cell, while scientist..... stated that all animals consist of cells.
- 2- Light microscope is composed of two lenses which are and
- 3- Light microscope has a magnification power of x, while electric microscope has a magnification power ofx
- 4- Scientist stated that cell is the functional unit of living organisms, while scientist Stated that all plants are composed of cells.
- 5- Scientist Invented a microscope in 1674 of magnification power ofx

3- Write the scientific term

- 1- The building unit of living organisms.
- 2- A microscope which depends on light and has a magnification power of 1500x
- 3- A microscope which gives clear magnified photos of samples with high differentiation.

4- Show the importance of

- 1- Light microscope
- 2- Electronic microscope
- 3- Scanning electronic microscope

4- *Transmission electronic microscope*

6- *Calculate the magnification power of a compound microscope in which:-*

- *The magnification power of its eyepiece equals 60x*
- *The magnification power of its objective lens equal 14x*

The Answers of lesson (2)

1- Choose

- 1- *Robert Hooke* 2- *Leeuwenhoek* 3- *Virchow* 4- *Light microscope*
5- *Light microscope*

2- Complete

- 1- *Robert Hooke, Theodor Schwann*
2- *Eyepiece, objective lens*
3- *1500x, 1,000,000x*
4- *Virchow, Schleiden*
5- *Leeuwenhoek, 200x*

3- Write the scientific term

- 1- *Cell* 2- *Light microscope* 3- *Electronic microscope*

6-

*The magnification power of light microscope = Magnification power of eyepiece
x magnification power of objective lens = $60 \times 14 = 840x$*

Lesson (2) Cell ultra structure



Cell is the functional and structural unit of living organisms, it can reproduce, respond to environment, and even respire!!

Cell parts

*Cell is composed of a protoplasmic substance surrounded by cell membrane
Protoplasm consists of **cytoplasm** and **nucleus**.*

Cells are divided into:-

- 1- Animal cells
- 2- Plant cells

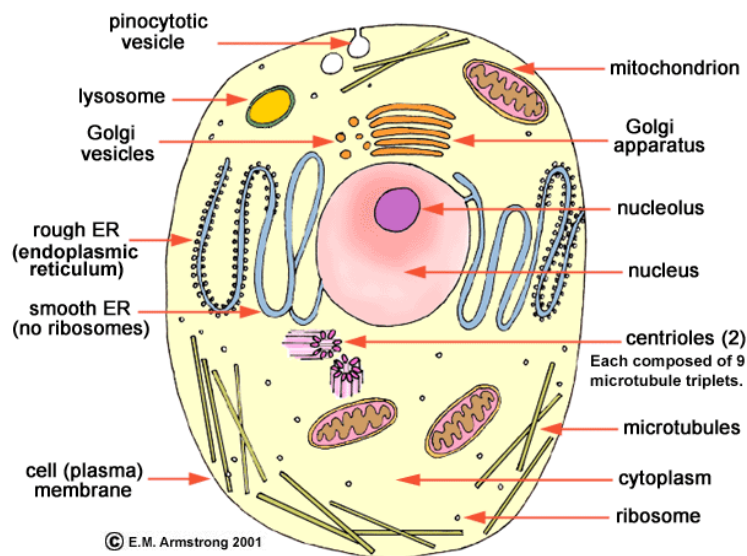


Fig. (5) Structure of animal cell

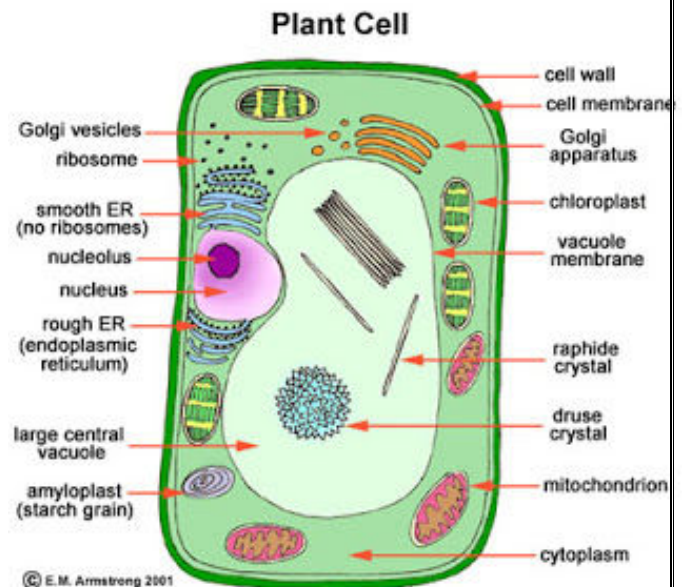


Fig. (6) Structure of plant cell

First: Cell wall

*The cells of some bacteria, fungi, plants and algae are surrounded by a wall of **Cell wall**.*

→ *Cell walls have holes and made up of cellulose fibres, which makes substances and water pass through them easily.*

Function of cell walls:-

They support and protect plant cells, and give them their definite shapes.

Second: Plasma membrane

Definition: *A thin membrane which surrounds the cell, it separates between the cell components and its external medium.*

Function:-

- 1- *It organizes the passage of substances to and from the cell.*
- 2- *It prevents the spread of cytoplasm outside the cell.*

Structure:-

Cell membrane is composed of phospholipid bi- layer. The hydrophilic heads (heads which can dissolve in water) of these molecules face the aqueous medium outside cell, while the hydrophobic tails (tails which cannot dissolve in water) exist inside.

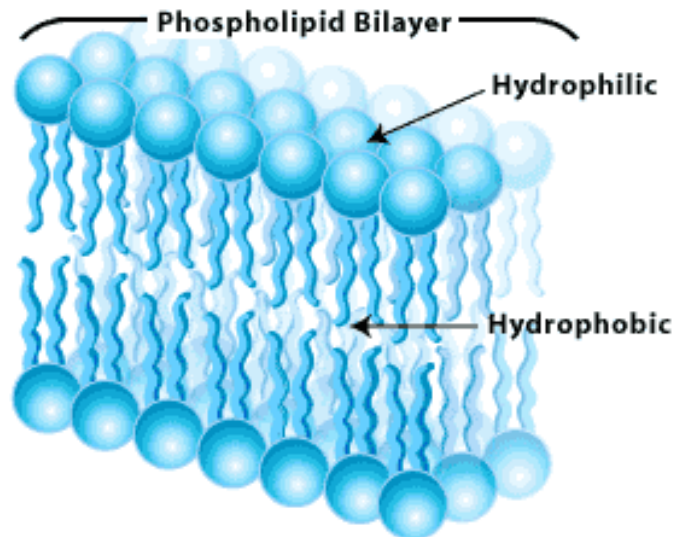


Fig. (7) Phospholipid bilayer in cells

There are some protein molecules between the two layer of phospholipids which work as:-

- Passages of the substances that enter and get out of the cell.
- Regions to identify the substances entering cells (such as hormones and nutrients)

→ Cell membrane is liquid (resembles oil in water) because the phospholipids forming it are in liquid state.

→ There are some cholesterol molecules bound to phospholipids in cell membrane to keep the membrane cohesive.

Third: Nucleus

Definition: The largest and most obvious organelle in cell, it has a spherical or ellipsoidal shape.

Nucleus consists of:-

1- Nuclear membrane

A double layer which separates between the components of the nucleus and cytoplasm. It has **nuclear pores** through which substances pass between the nucleus and cytoplasm

2- Nucleoplasm

A jelly-like transparent fluid which contains some filaments coiled around each other called **chromatins**

3- Nucleolus

There might be more than one nucleolus in cells (especially those which are responsible for secreting proteins like enzymes and hormones)

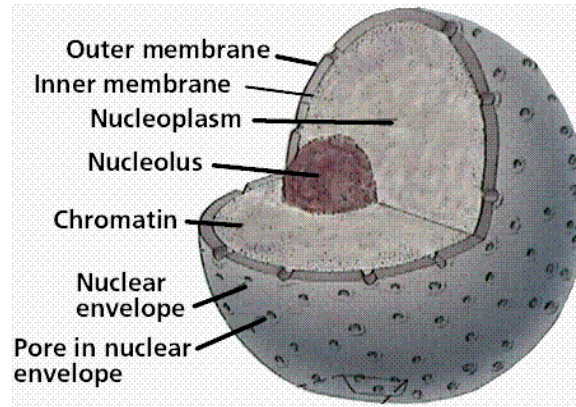


Fig. (8) Structure of nucleus

Structure of chromosomes:-

During cell division process, chromatins condense forming chromosomes. Chromosomes appear at Metaphase stage during cell division process in the form of two threads (two chromatids) attached together at a point called centromere

Structure of chromatids

- Chromatids are composed of DNA coiled around Histones proteins.
- DNA carries the hereditary traits of living organisms, which are being inherited across generations by reproduction process

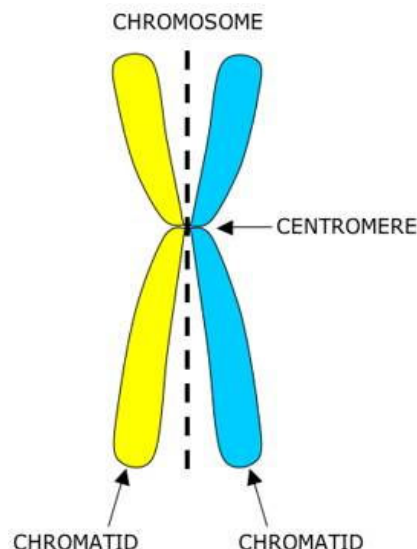


Fig. (9) Structure of chromosome

N.B: Chromosome (Word derived from Latin which means colour body) is called by this name because it is stained by basic dyes which makes it more obvious during cell division.

The importance of nucleus

- 1- It controls cell division process.
- 2- It contains the nucleolus which is responsible for forming ribosomes (which synthesize proteins).

Fourth: Cytoplasm

Definition: A semi-fluid substance filling the space between the nucleus and cell membrane. It's composed of water and other organic and inorganic substances.

Cytoplasm contains group of microtubes and filaments called cytoskeleton, which:-

- 1- Supports the cell.
- 2- Works as passages for the transport of substances within cell

Cytoplasm also contains cell organelles, they are divided into:-

Membranous organelles: Organelles surrounded by membranes

Examples: Golgi bodies – endoplasmic reticulum – plastids - mitochondria – Vacuoles.

Non-membranous organelles: Organelles which are not surrounded by membranes

Examples: ribosomes and centrosomes.

1- Ribosomes

→ They are non-membranous round organelles inside the cell which synthesize proteins, they exist in two regions of the cell:-

1- In Cytoplasm: They synthesize protein and send it immediately to the cytoplasm to be used in growth and renewal processes.

2- Attached to the external surface of endoplasmic reticulum: They are more than those in cytoplasm, they synthesize proteins which are send outside the cell through the inner endoplasmic reticulum after modifying them.

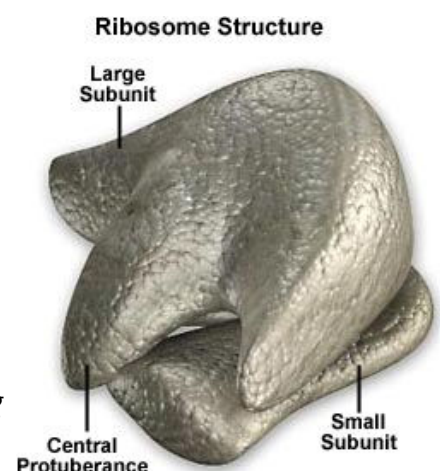


Figure 1

Fig. (10) Ribosome

2- Centrosome

→ A structure which exists in animal cells (except nerve cell). It is composed of two particles called centrioles

→ There aren't any centrosomes in plant, algae and most fungi cells, but instead, there are parts of cytoplasm that carry out the functions of centrosome.

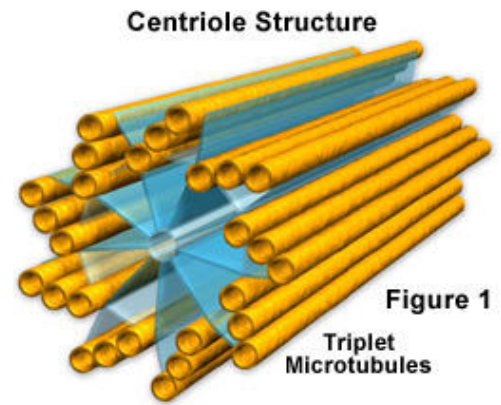


Fig. (11) centrioles

Function:-

1- It plays an important role in cell division process because spindle fibres between the two centrioles extend between the poles of cell, which helps the cell split into two cells.

2- It forms cilia and flagella.

3- Endoplasmic reticulum

→ A group of membranous microtubes which permeate all parts of cytoplasm, it is connected with both plasma and nuclear membranes.

Function: It transports substances across all parts of cell and from nucleus to cytoplasm.

Types of endoplasmic reticulum:-

Smooth Endoplasmic reticulum

It doesn't have any ribosomes, it works on:-

- 1- Synthesizing lipids in cells.
- 2- Changing carbohydrates into glycogen.
- 3- Changing the nature of some toxins to become less poisonous

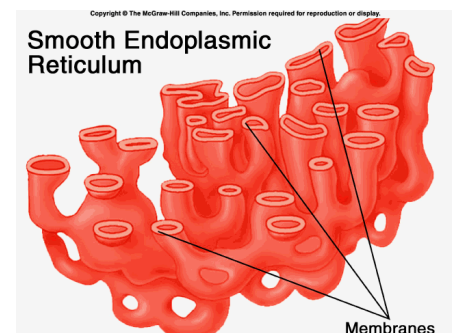


Fig. (12) Smooth endoplasmic reticulum

Rough Endoplasmic reticulum

It has a great no. of ribosomes, its works on

- 1- Synthesizing proteins in cells.
- 2- Modifying proteins produced by ribosomes
- 3- Producing new membranes for cells.

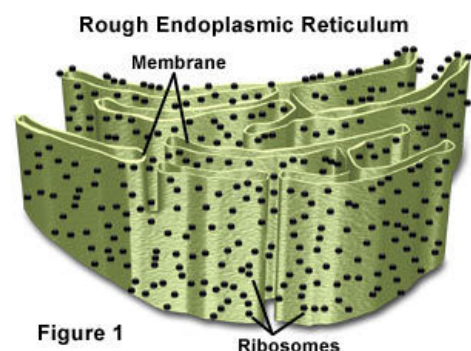


Fig. (13) Rough endoplasmic reticulum

4- Golgi body

→ A group of flat membranous sacs with spherical ends.

Function:-

- It receives the substances produced by endoplasmic reticulum through transport vesicles. Then, it classifies these substances, modify them, and send them to:-
- Parts of cells which may use them.
- Secretory vesicles which expel them from cell in the form of secretions.

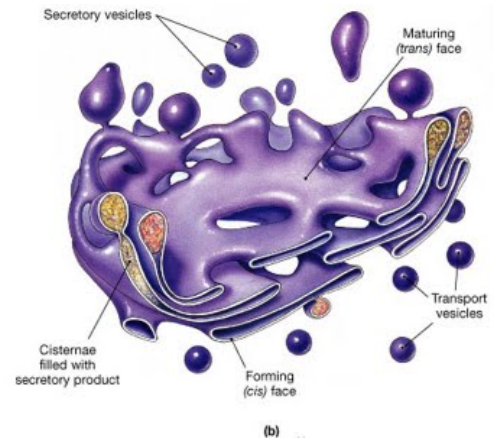


Fig. (14) Structure of Golgi body

(N.B: The no. of Golgi bodies inside cell differs according to the secretory activity of cell, The cells of glands have great no. Golgi bodies)

→ Golgi bodies were named after scientist "Camillo Golgi" who was the first to describe them in 1898.

→ Golgi bodies in plants and algae are called **Dictyosomes**

5- Lysosomes

→ They are small spherical membranous vesicles formed by Golgi bodies, they contain digestive enzymes within them.

Function:-

- 1- Getting rid of useless old and destroyed cells or organelles.
- 2- Digestion of nutrients being swallowed by cells and breaking them to simple substances.

→ White blood cells use Lysosomes in killing microbes.

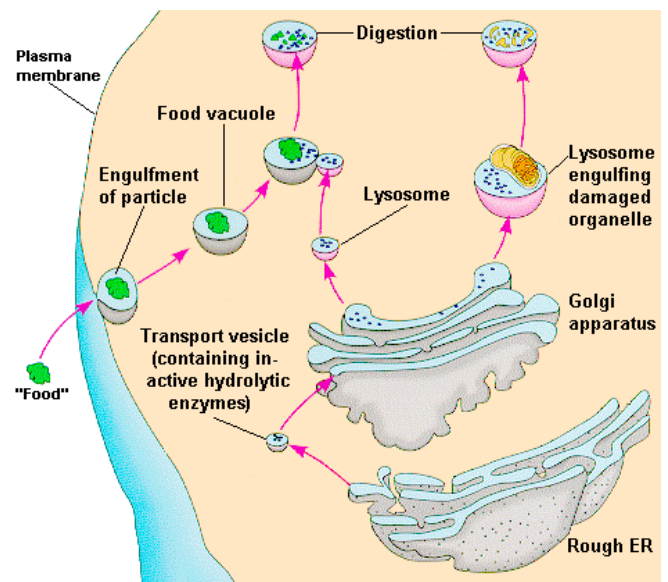


Fig. (15) Lysosomes function

→ Cell is not affected by the enzymes of Lysosomes because their enzymes are separated from the other components of cell by a membrane.

6- Mitochondria

→ A sac-like membranous structure that exists in all cells, it is composed of:-

1- Inner membrane

It includes folds in it called Cristae

2- Cristae

They are folds occurring in the inner membrane, they increase the surface area of the medium of chemical reactions occurring inside mitochondria to speed them up

3- Outer membrane

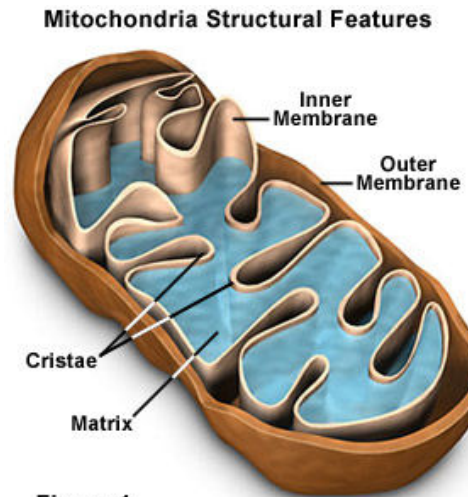


Figure 1

Fig. (16) Structure of mitochondria

Function of mitochondria

1- It stores respiratory enzymes in the cell

2- It stores substances which are formed as a result of oxidation of nutrients such as glucose.

3- It stores the energy resulted from respiration process in the form of a compound called Adenosine Triphosphate (ATP) from which the cell can release energy again.

7- Vacuoles

They are small membranous sacs which exist in cells, they exist with great no. in animal cells, they can accumulate in one or more bigger vacuoles in plant cells.

Function: They store water, wastes and food till the cell use or get rid of them.

8- Plastids

They are membranous organelles which have different shapes and exist in plant cells, there are three kinds of plastids which are classified according to the kind of pigments in them, they are:-

Leucoplasts (White plastids)

They are colourless plastids which don't contain any pigments.

Function: They store starch.

They exist in cells of:-

1- Inner cauliflower leaves

2- Potato roots

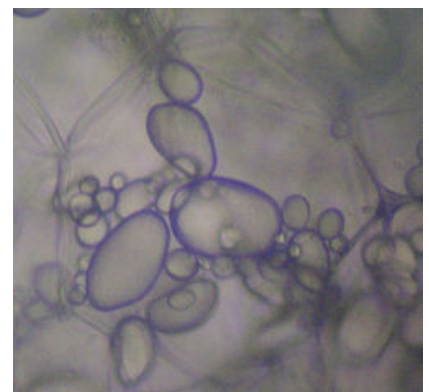


Fig. (17) Leucoplasts

2- Chromoplasts (Coloured plastids)

They contain pigments called Carotenoids, their colours may be red, orange or yellow.

They exist in cells of:-

- 1- Petals of flowers and fruits.
- 2- Roots of some plants such as radish

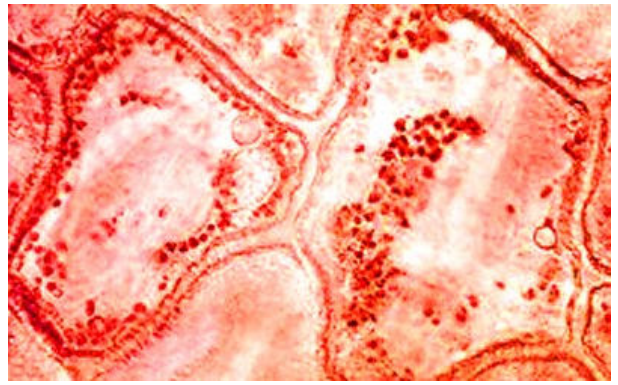


Fig. (17) Chromoplasts

3- Chloroplasts (Green plastids)

→ They contain chlorophyll pigment which change the light energy of sun to chemical energy stored in glucose chemical bonds

They exist in the cells of:

Green leaves and stems of plants.

Structure:-

A chloroplast consists of :-

- 1- Inner membrane
- 2- Outer membrane
- 3- Stroma: An inner filling surrounded by the bi-layer membrane
- 4- Granum: Stacks of inner membranes in the form of disks.

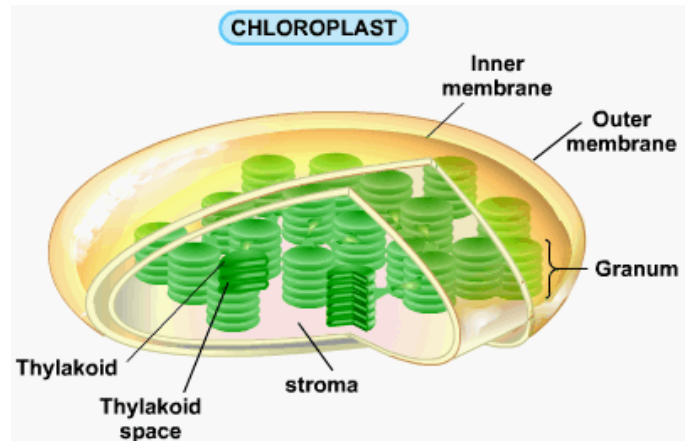


Fig. (18) Structure of a chloroplast

Prokaryotic and eukaryotic cells

Living organisms are classified according to their cells structure into:-

Prokaryotic cells: Such as bacteria

Eukaryotic cells: Such as Monera, protista, fungi, plants and animals

Common properties between prokaryotic and eukaryotic cells

- 1- They are surrounded by cell membranes which separate between their internal structures and their external mediums.
- 2- They both have cell organelles that allow cell carry out its vital processes.
- 3- They have cytoplasm in which cell organelles are suspended, it has substances which are essential for cell such as water, salts and enzymes.
- 4- They have the hereditary material essential for their reproduction which control all the processes within cells.

Prokaryotic cells

- 1- They are much smaller than eukaryotic cells
- 2- Their structures are less complex
- 3- They don't have any nuclei, as their hereditary material exist in cytoplasm directly
- 4- They don't have many organelles as eukaryotic cells. However, they can perform all cellular activities (nutrition, respiration, movement, reproduction, responding to environment...etc)

Eukaryotic cells

- 1- They are bigger than prokaryotic cells
- 2- They have complex internal structure
- 3- Their hereditary material are surrounded by nuclear membrane (they have nuclei)
- 4- They have many organelles

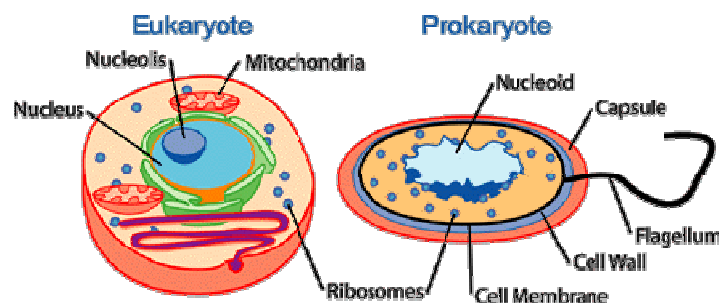


Fig. (20) Comparison between eukaryotic and prokaryotic cells

Definitions of lesson (2)

Cell wall: A wall made of cellulose which surrounds the cell membranes of plant cells and gives them definite shapes.

Cell membrane: A thin membrane which surrounds all cells, it consists of phospholipid bi-layer and allows the passage of substances to and from the cell.

Nucleus: The largest and most obvious organelle in eukaryotic cells which carries chromosomes which are responsible for transferring hereditary traits to the offspring.

Cytoplasm: A jelly-like fluid filling the space between the nucleus and cell membrane which consists of water, inorganic and organic compounds.

Ribosomes: Spherical organelles which occur in cytoplasm or endoplasmic reticulum of cells, they play an important role in protein synthesis process.

Centrosome: An organelle in animal cells which consists of two centrioles, it plays an important role in cell division process.

Endoplasmic reticulum: A group of membranous tubes which spread across the cell and connected with both cell and nuclear membranes, it plays an important role in transporting substances around the cell.

Golgi body: A flat membranous sac-like organelle which receives the substances transported by endoplasmic reticulum and distribute them across cell parts.

Lysosome: A small spherical membranous organelle which plays an important role in digesting nutrients and getting rid of wastes.

Mitochondria: An organelle inside living cells which plays an important role in generating energy.

Vacuoles: Membranous sacs inside cells which store water, nutrients and wastes

Plastids: Membranous organelles which occur in plant cells.

Leucoplasts: They are colourless plastids which don't contain any pigments.

Chromoplasts: They are coloured plastids which contain coloured pigments called carotenoids.

Chloroplasts: They are green plastids which contain green pigment called chlorophyll, they play an important role in photosynthesis process.

Prokaryote: A Cell whose hereditary material is not surrounded by a nuclear membrane and don't have many cell organelles such (ex. Bacteria)

Eukaryote: A Cell whose hereditary material is surrounded by a nuclear membrane and has many cell organelles.

Give reasons for

1- Plant cells have definite shapes

Because they are surrounded by cell walls made of cellulose which give plant cells their definite shapes

2- Cell membrane is in liquid state

Because the phospholipids forming it are in liquid state

3- Cell membrane is cohesive

Because there are cholesterol molecules bound to phospholipid ones, which makes the membrane cohesive

4- The importance of nuclear membrane in nucleus

Because it separates between the nucleus components and cytoplasm

5- Plasma membrane plays an important role in cell

Because it identifies the substances entering cells and allow their passage from and to them.

6- Nucleus is the most important organelle in cell

Because:-

1- It controls all processes occurring in cell

2- It contains chromosomes which contain genes (hereditary material)

3- It controls cell division process

4- It contains the nucleolus responsible for the formation of ribosomes which synthesize proteins.

7- Ribosome plays an important role in cell

Because it synthesizes proteins in cell

8- The importance of ribosomes which exist in cytoplasm

Because they synthesize proteins and send them to all cell parts to be used in vital processes like growth.

9- The importance of ribosomes which exist in endoplasmic reticulum

Because they synthesize proteins which the inner endoplasmic reticulum send out of the cell in the form of secretions

10- Centrosome plays an important role in animal cells.

Because it plays an important role in cell division process, as its centrioles migrate towards the two poles of cell forming spindle fibres. It also forms cilia and flagella which helps the cell move.

11- The importance of the smooth endoplasmic reticulum

Because it synthesizes lipids, changes carbohydrates into glycogen, and make some toxics less poisonous

12- The importance of rough endoplasmic reticulum

Because it contains a great number of ribosomes to synthesize proteins and modifies them, too.

13- Chromosome are called by this name

Because they contain basic dyes that colour them , as the word chromosomes is derived from Latin language and means "colour body"

14- Golgi bodies are called by this name

To honour scientist "Camillo Golgi" who discovered them in 1898.

15- Golgi bodies play an important role in cells

Because they receive substances produced by ER and transport them across the cell or expel them out of it in the form of secretions.

16- The importance of Lysosomes in cells.

Because they get rid of old and destroyed organelles or cells, and contain digestive enzyme that digest nutrient inside cells.

17- The importance of Lysosomes in white blood cells

Because they destroy microbes

18- Cell is not affected by the digestive enzymes of Lysosomes

Because Lysosomes are surrounded by membranes.

19- Mitochondria have folds in their inner membranes called Cristae

In order to increase the surface area on which chemical reactions occur to speed them up

20- The biological importance of Mitochondria inside living cells

Because they store respiratory enzymes, substances which contain stored energy, and the energy resulted from respiration in the form of a compound called Adenosine Triphosphate (ATP)

21- Most cells have vacuoles

To store water ,nutrients and wastes

21- Plant cells can perform photosynthesis process, while animal cells cannot

Because plant cells have chloroplasts containing chlorophyll, which change light energy of sun into chemical energy and store it in glucose chemical bonds, while animal cells do not have these chloroplasts.

22- Bacteria are prokaryotes

Because their hereditary materials are not surrounded by nuclear membranes but exist in cytoplasm, and they do not have many cellular organelles

23- Human cells are eukaryotic cells

Because their hereditary material are surrounded by nuclear membranes, and they contain many cellular organisms.

24- There are many Golgi bodies in glandular cells

Because Golgi bodies in these cells are responsible for secreting hormones.

What happens if

1- Plant cells were not surrounded by cell walls.

They would not have definite shapes

2- Cell walls didn't have any pores (holes)

Water and dissolved substances would not be able to enter plant cells.

3- Nuclei of eukaryotes did not have any nuclear membranes surrounding them.

The components of nucleus would mix with cytoplasm

4- Cells didn't have ribosomes

Cells wouldn't be able to synthesize proteins

5- Animal cells didn't have centrosome

They wouldn't be able to divide into two cells, as the two centrioles of centrosome form spindle fibres across the cell during cell division process (which help the cell divide into two cells)

6- Cells lack endoplasmic reticulum

Substances won't be transported across and outside the cell.

7- Cells didn't have smooth endoplasmic reticulum

They wouldn't be able to synthesize lipids or form new membranes for cellular organelles.

8- Cells didn't have Golgi bodies

Substances wouldn't be transported from the endoplasmic reticulum to other parts of cell.

9- White blood cells didn't have Lysosomes

They wouldn't be able to destroy microbes

10- Living cells didn't have Lysosomes

They wouldn't be able to digest nutrients or get rid of wastes.

11- Lysosomes of cells are not surrounded by membranes

The digestive enzymes inside the cell would spread in cytoplasm which may harm it.

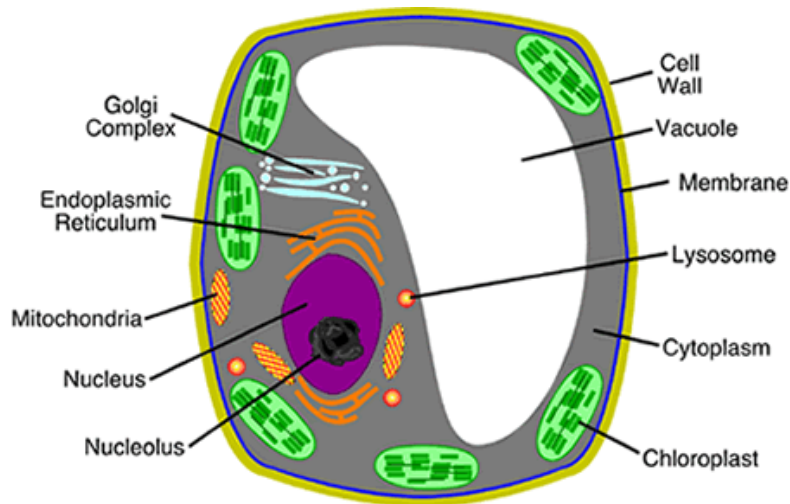
12- Cells didn't have mitochondria

They will not be able to store energy or respiration enzymes.

13- Plant cells didn't have chloroplasts

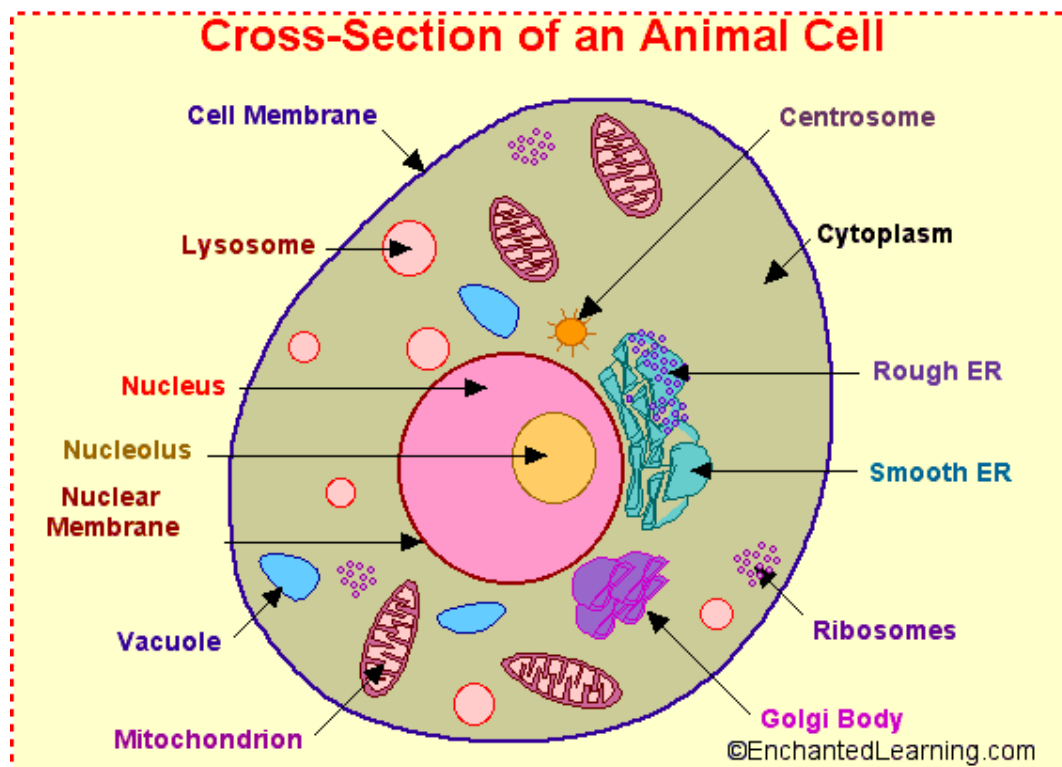
They will not be able to perform photosynthesis process

The structure of plant cell



The structure of animal cell

Cross-Section of an Animal Cell



Questions

1- Choose the correct answer

- 1- Cell wall is formed from organic compound
 A- Lipids B- Glucose C- Phosphoproteins D- Cellulose
- 2- Cell membrane is composed of

A- Phospholipids bi-layer

B- Cellulose layer

C- Chitin bi-layer

D- Glycoprotein bi-layer

3- are responsible for protein synthesis process in living cells.

A- Mitochondria B- Lysosomes C- Cytoskeleton D- Ribosomes

4- Centrosome exists in all animal cell except for.....

A- Nerve cells B- Sperm cells C- Liver cells D- Muscle cells

5- Chromosomes are formed in Stage of cell division

A- Anaphase B- Metaphase C- Telophase D- Prophase

6- form cilia and flagella in animal cells

A- Centrosome B- Mitochondria C- Lysosome D- Ribosome

7- is responsible for generating energy in cell

A- Centrosome B- Mitochondria C- Lysosome D- Ribosome

8- is responsible for digesting nutrients in cell.

A- Centrosome B- Mitochondria C- Lysosomes D- Ribosomes

9-..... are plastids which are devoid of pigments

A- Leucoplasts B- Chromoplasts C- Chloroplasts D- Chromatin

10- All the following organelles exist in animal cells except

A- Cell wall B- Cell membrane C- Mitochondria D- Lysosomes

11 cells do not have true nuclei.

A- Bacteria B- Monera C- Plants D- Animals

2-Write the scientific term

1- A cell that doesn't have a true nucleus and most cellular organelles

2- A cell which has a true nucleus and many cellular organelles.

3- A structure which is responsible for synthesizing proteins.

4- A structure which is responsible for synthesizing lipids.

5- A structure responsible for digesting nutrients

6- Pigments which exist in chromoplasts

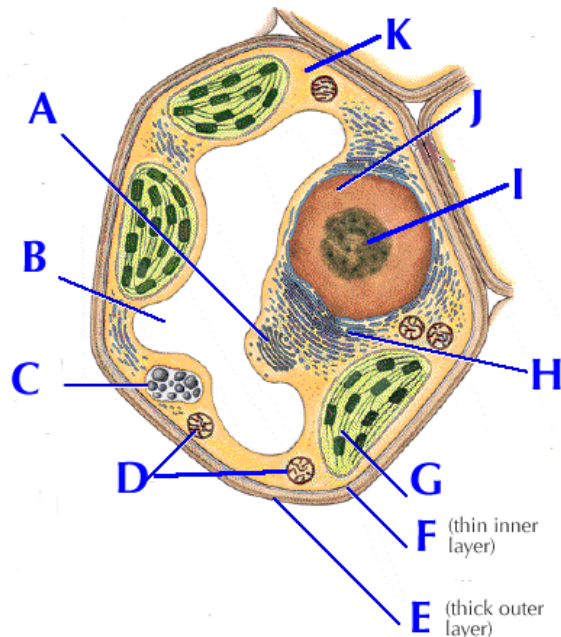
7- A pigment which exist in chloroplasts

8- Thin filaments coiled around each other which turn into chromosomes during cell division process.

4- Compare between

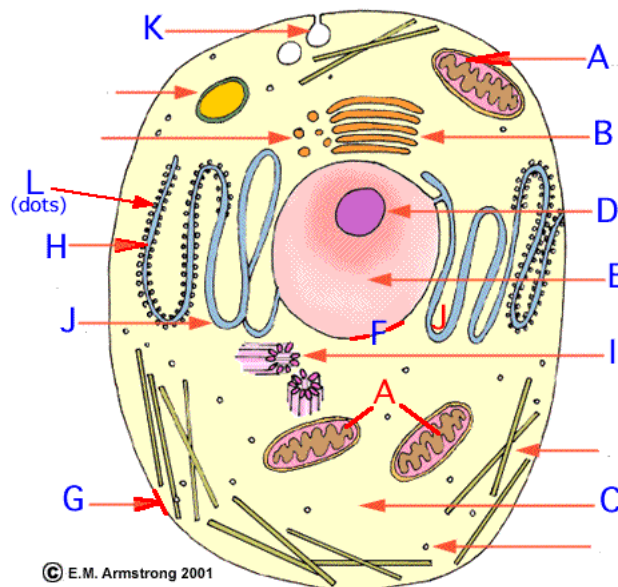
- 1- Animal and plant cell
- 2- Prokaryote and eukaryote

5- This is the diagram of a typical plant cell, answer the following question



- 1- Label the previous cell
- 2- Mention the function of (A), (D) and (G)
- 3- Which organelle is responsible for synthesizing proteins?

6- This is the diagram of a typical animal cell, answer the following questions



- 1- Label the previous cell
- 2- Mention the function of (A), (I), (J)
- 3- Which organelle is responsible for synthesizing lipids in cell

The answers of lesson (2)

1- Choose

1- Cellulose 2- Phospholipid bilayer 3- Ribosomes 4- Nerve cells
5- Metaphase 6- Centrosome 7- Mitochondria 8- Lysosomes 9- Leucoplasts
10- Cell wall 11- Bacteria

2- Write the scientific term

1- Prokaryote 2- Eukaryote 3- Ribosomes 4- smooth endoplasmic reticulum
5- Lysosomes 6- Carotenoids 7- Chlorophyll

3- Compare between

1- Animal and plant cells

<i>Animal cell</i>	<i>Plant cell</i>
<ul style="list-style-type: none"> - It has a centrosome whose two centrioles form spindle fibers in cell division process - It is surrounded by plasma membrane 	<ul style="list-style-type: none"> - It doesn't have centrosome, but has a part of cytoplasm which form spindle fibres in cell division process - Cell wall made of cellulose surrounds the plasma membrane

2- Prokaryote and eukaryote cells

<i>Prokaryotic cells</i>	<i>Eukaryotic cells</i>
<ul style="list-style-type: none"> - They are less complex cells - Their hereditary materials are not surrounded by nuclear membranes. - They lack many cellular organelles. (ex. Bacteria) 	<ul style="list-style-type: none"> - They are more complex cells - Their hereditary materials are not surrounded by nuclear membranes - They contain many cellular organelles (ex. Animals)

5- Plant cell

1- Label

A- Golgi body B- Vacuole C- Mitochondria D- Ribosomes E- Cell wall
F- Cell membrane G- Chloroplast H- Rough endoplasmic reticulum
I- Nucleolus J- Nucleus K- Cytoplasm

2- Function

(A) Golgi bodies: It modifies and transports the substances sent to them from the ER across the cell or outside it.

(D) Ribosomes: They synthesize proteins.

(G) Chloroplast: Perform photosynthesis process.

3- (D) ribosomes

6- Animal cell

1- Label

*A- Mitochondria B- Golgi body C- Cytoplasm D- Nucleolus E- Nucleus
F- Nucleus G- Plasma membrane H- Rough endoplasmic reticulum
I- Centriole J- Smooth endoplasmic reticulum K- Vacuole L- Ribosome*

2- Function

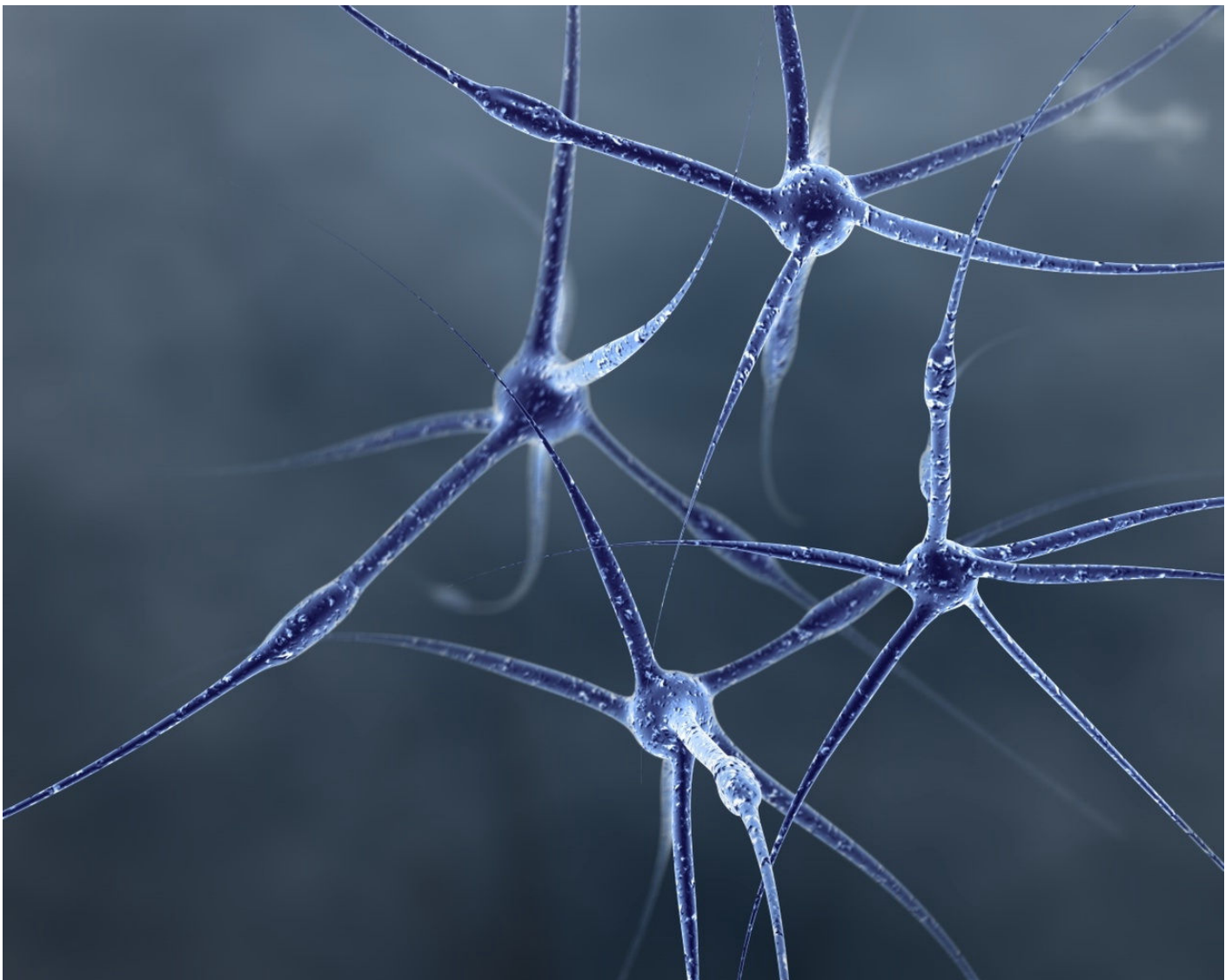
(A) Mitochondria: Stores and generates energy.

(I) Centriole: forms spindle fibres across the cell during cell division process.

(J) Smooth ER: Changes carbohydrates to glycogen – synthesize lipids

3- Smooth endoplasmic reticulum

Lesson (3) Differentiation of cells and diversity of plant and animal tissues



Organization of living organisms

→ There are many types of cells, every kind of cells has a particular function, cells unite together forming tissues .

There are two types of tissues, which are:-

Simple tissues: They are tissues formed from identical cells.

Complex tissues: They are tissues formed from different types of cells.

Tissues unite together forming organs (ex. Heart), organs unite together forming systems (ex. Circulatory system). These systems form living organisms' bodies

Plant tissues

1- Simple tissues

1- Parenchyma tissue

Definition: A living tissue with thin and flexible walls whose cells have spherical or ellipsoidal shapes. These cells may be coloured, green or colourless.

→ There are spaces for aeration between the cells of Parenchyma tissue. Parenchyma cell contains one or more vacuoles filled with water and mineral salts.

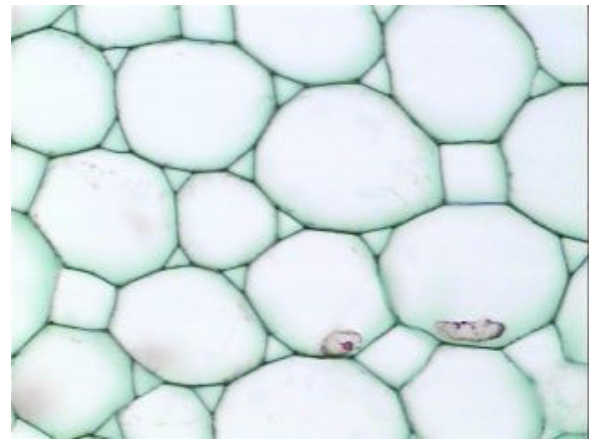


Fig. (21) Parenchyma tissue

Function of Parenchyma tissue:-

- 1- Performing photosynthesis process
- 2- Storing nutrients such as starch
- 3- Responsible for aeration.

2- Collenchyma tissue (flexible tissue)

Definition: A living tissue whose cells are semi-rectangular, its walls are irregularly thickened with cellulose.

Function: Supporting the plant by providing it with suitable flexibility.

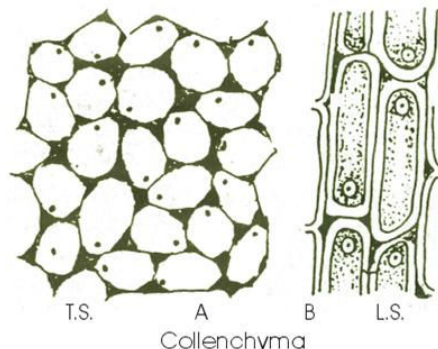


Fig. (22) Collenchyma tissue

3- Sclerenchyma tissue (solid tissue)

Definition: A non-living tissue, the walls of its cells are thickened by a substance called Lignin.

Function of Sclerenchyma tissue: It supports the plant and gives it flexibility and solidity.

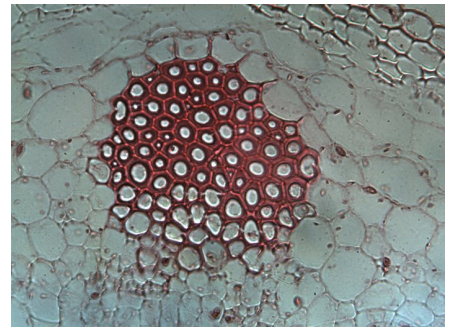


Fig. (23) Sclerenchyma tissue

2- Complex tissue

They are divided into:-

1- Xylem (wood tissue)

They are composed of :-

- **Xylem vessel elements:** They are tubes which consist of a vertical row of cells which lost protoplasm and their horizontal walls. Then, Lignin precipitated inside those cells changing them to long wide vessels through which water and mineral salts can be transported.
- **Xylem tracheids:** Each tracheid is composed of one cell which lost protoplasm and its cell wall is thickened with Lignin.

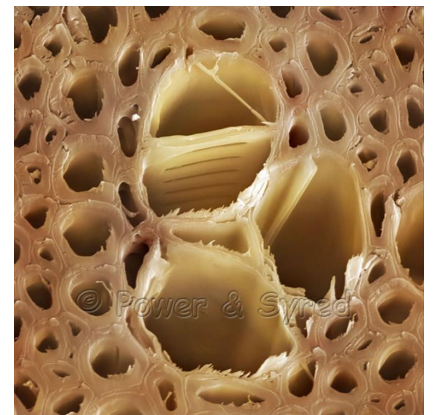


Fig. (24) Xylem tissue

- Parenchyma cells

Function of xylem:-

- 1- It transports salts and water from roots to leaves
- 2- It supports the plant

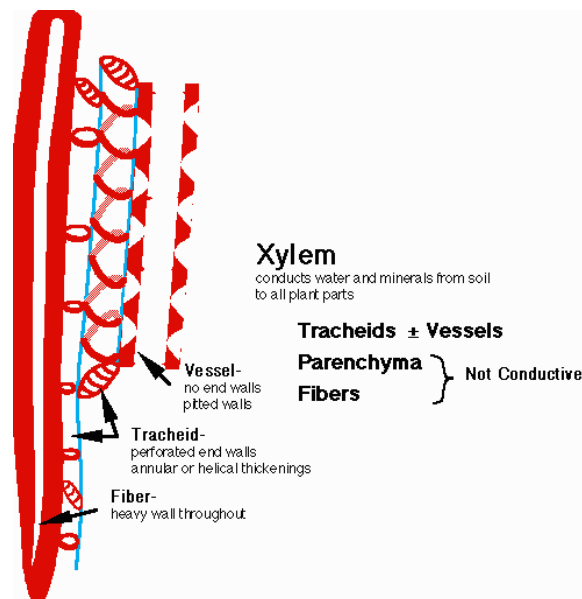


Fig. (25) Structure of xylem

2- Phloem

→ Sieve cells are formed from vertically-arranged cells which lost their nuclei and their walls separating between them became holed which are known as Sieve plates. Cytoplasm permeates these sieve plates in the form of cytoplasmic filaments.

→ There are some living cells near sieve tubes known as companion cells, these cells provide sieve tube with energy.

The function of Phloem:-

It transports the substances resulted from photosynthesis process from leaves to all parts of plant.

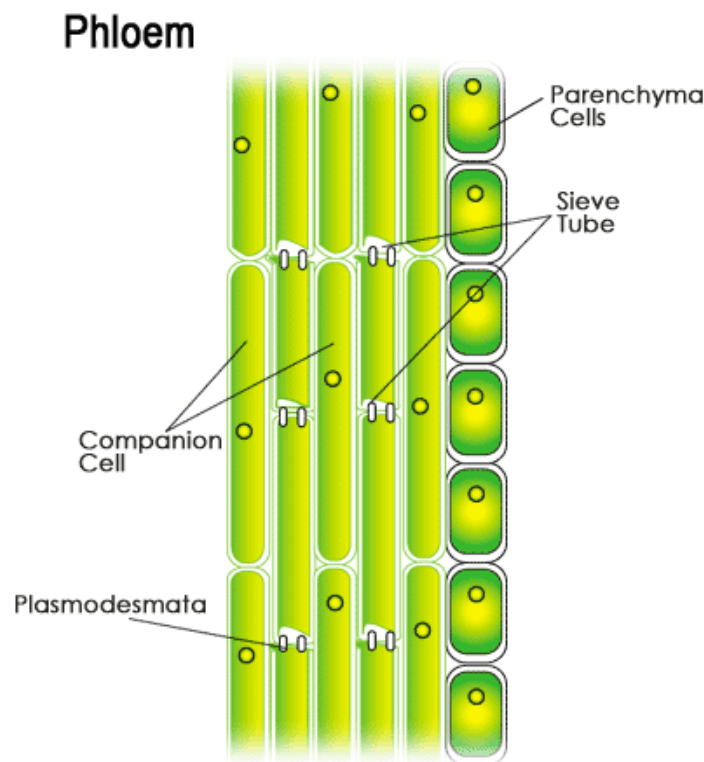


Fig. (26) Phloem structure

Animal tissues

1- Epithelial tissues

→ They are cells which cover the surface of body or line its cavity, it consists of a great number of attached cells with little intracellular substances between them. There are two types of epithelial tissues, which are:-

1- Simple epithelial tissues

Their cells are ordered in one layer, for example:-

1- Simple squamous epithelial tissue: It is composed of one layer of flat cells

Examples: Capillary linings – The walls of air alveoli in lungs

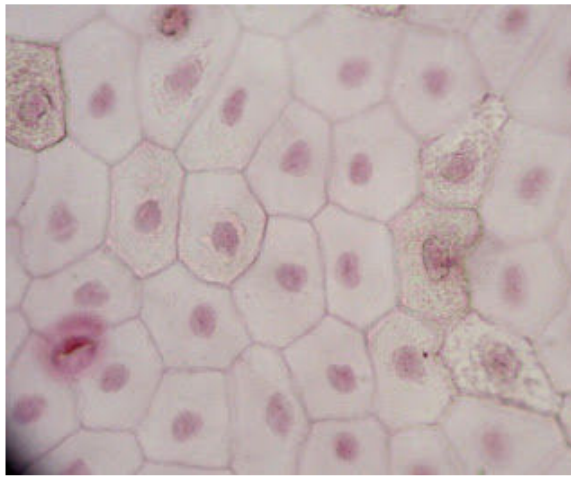


Fig. (27) Simple squamous epithelial tissue

2- Simple cuboidal epithelial tissue: It is composed of one layer of cuboidal cells.
Examples: The lining of kidney tubules.



Fig. (28) Simple cuboidal epithelial tissue

3- Simple columnar epithelial tissue: Composed of one layer of columnar cells.
Examples: The lining of stomach and intestine



Fig. (29) Simple columnar epithelial tissue

2- Complex (stratified) epithelial tissue

Its cells are arranged in many layers

Stratified squamous epithelial tissue: *It is composed of many layers or arranged cells above each other, the upper layer is squamous.*

Example: Skin

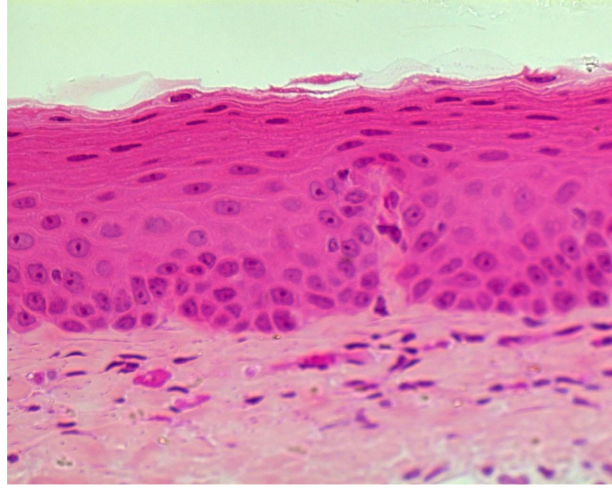


Fig. (30) Stratified squamous epithelial tissue

The functions of epithelial tissues:-

They perform different functions according to their locations, such as:-

- *Absorbing water and digested food as in the lining of small intestine.*
- *Protecting the cells they cover from dryness and harms as in skin*
- *Secreting mucus to keep the cavity soft and moist as in air trachea and digestive canal*

2- Connective tissues

→ *They are composed of relatively distant cells, the intracellular spaces between them are filled by liquid, semi-solid, or solid substances..*

Connective tissues are classified according to the type of intracellular material into:-

1- Proper connective tissues: *The most common type, it has a medium degree of solidity and high flexibility*

Function: *Connecting tissues and different organs with each other.*

Example: *Under skin – Peritoneum (in small intestine)*

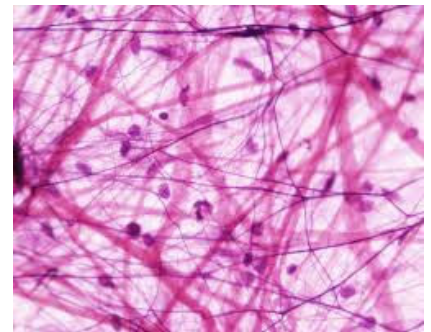


Fig. (31) Proper connective tissue

2- Skeletal connective tissue: It has solid intracellular substance (in bones, calcium is precipitated in it)

Examples: Bones – Cartilages

Function: Supporting the body

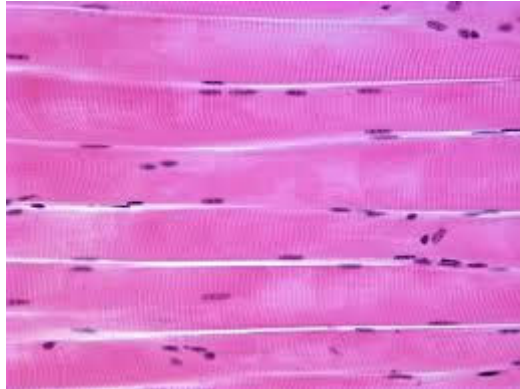


Fig. (32) Skeletal connective tissue

3- Vascular connective tissue: It has liquid intracellular substance.

Function: Transporting digested food, gases and excretions.

Examples: Blood – Lymph

3- Muscular tissues

They have the ability to contract and relax, which enable living organisms to move.

There are three kinds of muscular tissues, which are:-

1- Smooth muscles: They are composed of involuntary non-striated muscles fibres.

Examples: They exist in the wall of digestive canal, urinary system and blood vessels

2- Skeletal muscles: They are composed of striated voluntary muscles, they are usually found attached to the skeleton.

Example: The muscles of hands, legs and stem

3- Cardiac muscles: They are composed of striated involuntary muscles, they are found in the walls of heart only. Cardiac muscles contain intercalated disks which are attached to muscle fibers, they make heart pump blood regularly.

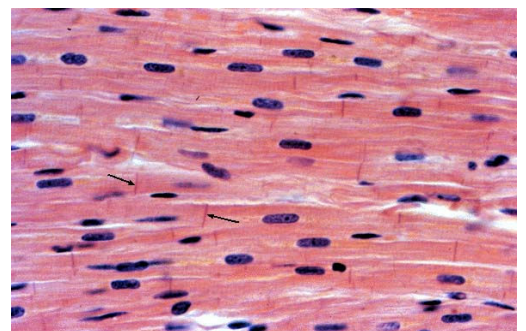


Fig. (33) Cardiac muscles

4- Nervous tissues

They are responsible for regulating the different functions of body organs because:-

They receive sensory stimuli inside or outside the body and send them to the brain and spinal cord. Then, it sends movement orders to responding organs.

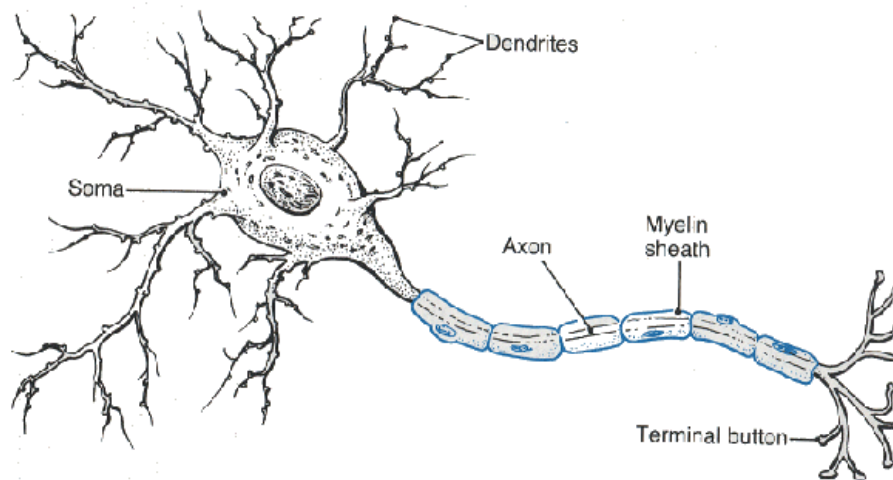


Fig. (34) Nerve cell

Definitions of lesson (3)

Parenchyma tissue: A living tissue composed of irregular cells with thin walls and intracellular distances between them. It is responsible for aeration, photosynthesis process and storing nutrients like starch.

Collenchyma tissue: A living tissue composed of rectangular cells, its walls are not thickened with Lignin but with cellulose.

Sclerenchyma tissue: A tissue which supports the plant and protects its inner tissues.

Epithelial tissue: A tissue which covers the outer surface of the body to protect it from outer stimuli (Temperature, Dryness, Microbes,) or lines the body from inside.

Connective tissue: A tissue whose cells are relatively distant and it has a solid, liquid or semi-solid intracellular material.

Muscular tissue: A tissue which is known as muscular cells or fibres, it has the ability to contract and relax (which doesn't exist in all body cells).

Smooth muscles: Muscles which are composed of involuntary non-striated muscle fibres.

Skeletal muscles: They are composed of striated voluntary muscles, they are usually found attached to the skeleton.

Cardiac muscles: They are composed of striated involuntary muscles, they are found in the walls of heart only

Nervous tissue: A tissue whose cells receive sensory stimuli and transporting movements orders.

Give reasons for

1- Parenchyma tissues play an important role in plants

Because they are responsible for aeration and photosynthesis processes and storage of nutrients such as starch in plants

2- Collenchyma tissues are very important in plants

Because it supports the plant by making it flexible

3- The biological importance of Sclerenchyma tissues

Because they support the plant by making it flexible and solid

4- Xylem is from the most important tissues in plants and trees

Because it transports water and salts from their roots to their leaves

5- Phloem is from the most important tissues in plant and trees

Because it transports nutrients produced by photosynthesis process from plants' leaves to all their parts

6- In phloem tissues, there are living cells attached to these tissues sieve tubes

In order to provide them with energy

7- Epithelial tissues cover the outer surface of living organisms

In order to protect the cells under these surfaces from microbes, damage and dryness

8- Epithelial tissues line the small intestines of living organisms

To absorb water and digested food

9- Epithelial tissues exist in cavities such as digestive canal and air trachea

In order to keep them moist and soft by secreting mucus

10- Proper connective tissues are from the most important tissues in living organisms

Because they connect different tissues and organs with each other

11- The biological importance of vascular connective tissues

Because they transport water, nutrients and wastes around the bodies of living organisms

12- Skeletal muscles are so-called (called by this name)

Because skeletal muscles are found attached to skeleton (such as the muscles of hands and legs)

13- Cardiac muscles are found attached to intercalated disks.

To allow heart work and pump blood regularly

14- Muscle tissues have so many mitochondria

To provide muscles with the energy required for them to perform their functions perfectly.

What happens if

1- Plants and trees didn't have Parenchyma tissue

Plants wouldn't be able to perform photosynthesis process and store nutrients.

2- Plants and trees didn't have Collenchyma (or Sclerenchyma) tissues

The plant wouldn't be flexible

3- Xylem tissues didn't exist in trees and plants

The roots of plants wouldn't be able to transport salts and water to their leaves, and the plant won't be supported

4- Phloem tissues didn't exist in trees and plants

The nutrients produced during photosynthesis process wouldn't be transported from the plants' leaves to all its parts.

5- The outer surfaces of organisms weren't covered with epithelial tissues.

Their cells would be damaged

6- Epithelial tissues in small intestine disappears.

It won't be able to absorb food and water

7- Epithelial tissues in cavities like air trachea are absent

Mucus won't be secreted in these cavities and they won't be moist and soft.

8- Muscle tissues cells don't have many mitochondria

They will work improperly due to the lack of energy.

Questions

1- Choose the correct answer

- 1- The tissue which is responsible for storing nutrients in plants
A- Parenchyma B- Sclerenchyma C- Collenchyma D- Phloem
- 2- Cell walls of Collenchyma tissues cells are thickened with
A- Lignin B- Cellulose C- Chitin D- Glucose
- 3- The solid tissue is known as
A- Sclerenchyma B- Collenchyma C- Epithelium D- Parenchyma
- 4- The cell walls of Sclerenchyma tissues cells are thickened with.....
A- Lignin B- Cellulose C- Chitin D- Glucose
- 5- The tissue which is responsible for transporting water and salts from roots to leaves.
A- Xylem B- Phloem C- Sclerenchyma D- Parenchyma
- 6- The plant tissue which transport nutrients from leaves to all plant parts.
A- Collenchyma B- Sclerenchyma C- Xylem D- Phloem
- 7- An epithelial tissue which forms the lining of capillaries
A- Simple columnar epithelial tissue
B- Simple vascular epithelial tissue
C- Simple squamous epithelial tissue
D- Stratified squamous epithelial tissue
- 8- A tissue formed from one layer of flat cells.
A- Simple columnar epithelial tissue
B- Simple vascular epithelial tissue
C- Simple squamous epithelial tissue
D- Stratified squamous epithelial tissue
- 9- A tissue forming kidney tubules.
A- Simple columnar epithelial tissue
B- Simple vascular epithelial tissue
C- Simple squamous epithelial tissue
D- Stratified squamous epithelial tissue

10- *Tissues which support body.*

- A- *Skeletal connective tissues*
- B- *Vascular connective tissues*
- C- *Simple squamous epithelial tissue*
- D- *Stratified squamous epithelial tissue*

11- *..... are formed from non-striated involuntary muscle fibers*

- A- *Smooth muscles*
- B- *Skeletal muscles*
- C- *Cardiac muscles*
- D- *Skeletal connective tissues*

12- *..... are formed from striated voluntary muscle fibers*

- A- *Smooth muscles*
- B- *Skeletal muscles*
- C- *Cardiac muscles*
- D- *Skeletal connective tissues*

2- Write the scientific term

1- *A living tissue composed of irregular cells with thin walls and intracellular distances between them for aeration*

2- *A living tissue composed of rectangular cells, its wall are not thickened with Lignin but with cellulose*

3- *A tissue which supports the plant and protect the inner tissues.*

4- *A tissue which covers the outer surface of body to protect it from outer stimuli (Temperature, Dryness, Microbes,) or line the body from inside.*

5- *A tissue whose cells are relatively distant and it has a solid, liquid or semi-solid intracellular material.*

6- *A tissue which is known as muscular cells or fibres, it has the ability to contract and relax (which doesn't exist in all body cells)*

7- *Muscles which are composed of involuntary non-striated muscles fibres.*

8- *They are composed of striated voluntary muscles, they are usually found attached to the skeleton.*

9- *They are composed of striated involuntary muscles, they are found in the walls of heart only*

The answers of lesson (3)

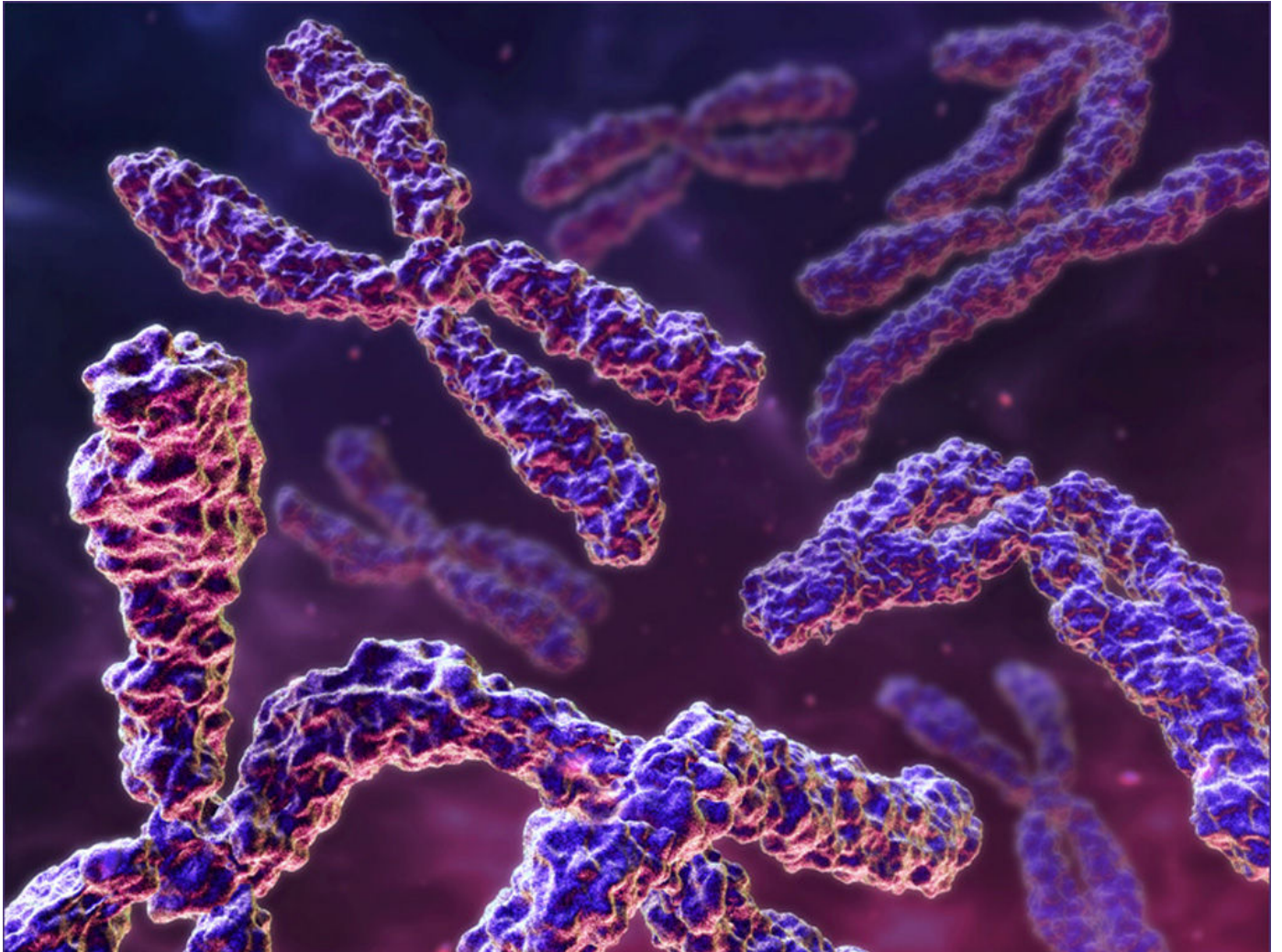
1- Choose

1- Parenchyma 2- Cellulose 3- Sclerenchyma 4- Lignin 5- Xylem
6- Phloem 7- Simple squamous epithelial tissue 8- Simple squamous epithelial tissue
9- Simple cuboidal epithelial tissue 10- Skeletal connective tissue
11- Smooth muscle 12- Skeletal

2- Complete

1- Parenchyma 2- Collenchyma 3- Sclerenchyma 4- Epithelial tissue
5- Connective tissue 6- Muscular tissue 7- Smooth muscle 8- Skeletal muscles
9- Cardiac muscles

Lesson (4) Cell processes



Cells perform many vital processes such as respiration, movement, nutrition, reproduction...etc. In this lesson, we'll study some of these cellular processes

Cellular Transport

→ Cells get substances from the surrounding medium, and get rid of wastes by expelling them to the surrounding medium.

→ Cell membrane has a property called selective permeability. This means that some substances (such as water, oxygen, carbon dioxide) can pass through it, while other substances (such as big molecules and salts) cannot do so. This depends on many factors such as:-

- 1- Size of particles
- 2- Charge of particles
- 3- The difference of concentration between the two sides of cell membrane

Substances are transported to and from cells by the following methods:-

1- Passive transport

Passive transport: The movement of substances through cell membrane where cell doesn't consume any energy.

Passive transport has the following methods:-

1- Diffusion

Diffusion: The movement of molecules through membrane from a region of high concentration to a region of low concentration, which makes the concentration of molecules on both sides equal.

Example:-

→ The exchange of carbon dioxide and oxygen gases between the inner and outer mediums of the cell during respiration process.

→ If the concentration of molecules in cell is greater than that of the external medium, molecules move from the cell to the external medium to balance the concentration of both sides

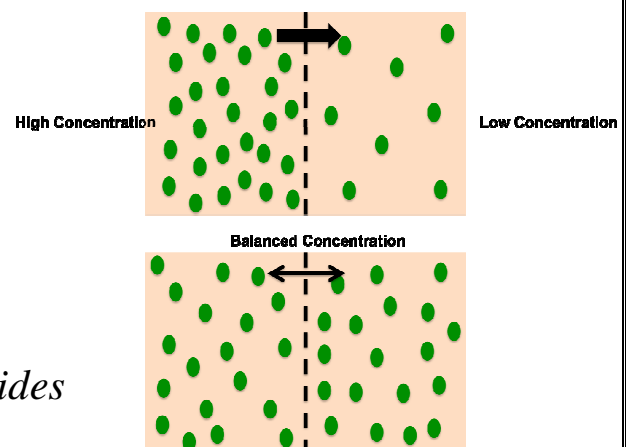


Fig. (35) diffusion process

2- Osmosis

Osmosis: The movement of pure water molecules through a membrane from a region of low concentration to a region of high one, which makes the concentration of both sides equal.

→ Water transports from and to cell due to the difference between the concentration of cytoplasm (fluid inside the cell) and the external medium.

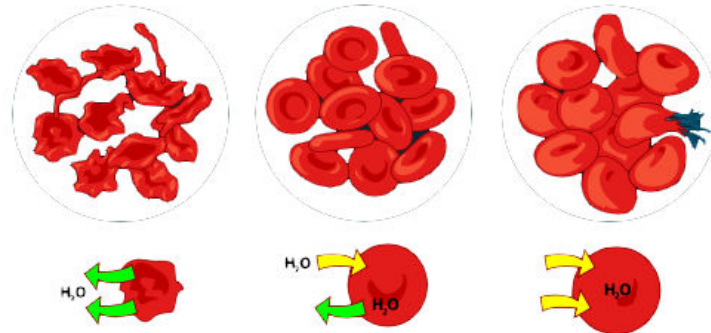


Fig. (36) Red blood cells and osmotic pressure

1- When we put cells in a solution of low concentration, water transports from the external medium (low concentration) into the cell (high concentration), which tears up cells.

2- When we put cells in a solution of equal concentration, water transports equally between the two mediums, and cells sizes don't change

3- When we put cells in a solution of higher concentration, water transports from the cell (low concentration) to the external medium (high concentration), which makes cells shrink.

3- Facilitated transport

Facilitated transport: The transport of molecules through a membrane by means of carrier protein (which carries molecules), where the cell doesn't consume any energy.

Example:-

Glucose is being transported to cells carried by carrier proteins.

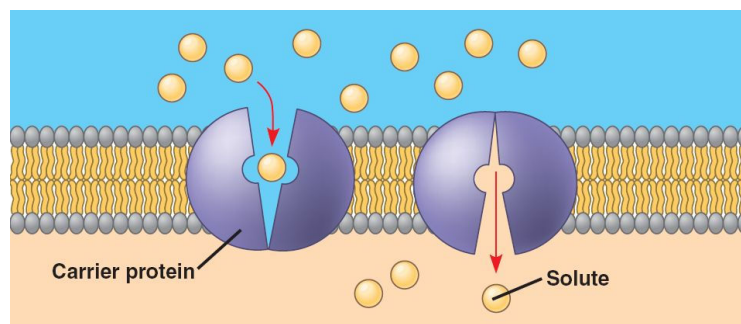


Fig. (37) How facilitated transport occurs.

2- Active transport

Active transport: The transport of big molecules and ions through cell membrane against their concentration gradient (from low to high concentration) using energy

Active transport balance the concentration of ions inside cells

Active transport and nerve cells

Active transport allows nerve cells control the concentration of sodium and potassium ions in them, which allows sending nerve impulses to muscle cells.

Active transport and plant cells

It allows root cells absorb the ions of soil salts (though the concentration of ions in these cells is lower than that of soil)

3- Bulk movement

Bulk movement: Transporting relatively big molecules (such as wastes and protein particles) through cell membranes.

There are two kinds of bulk movements, which are:-

1- Exocytosis

Exocytosis: Transporting substances out of the cell through plasma membrane

How do Exocytosis take place:-

- 1- Golgi bodies store wastes in its vacuoles (Golgi vacuoles)
- 2- They move through cytoplasm to plasma membrane to fuse with it
- 3- They empty these wastes outside the cell.

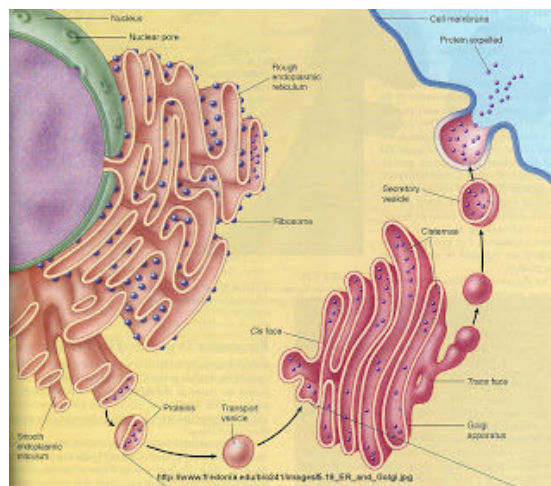


Fig. (38) Golgi body and Exocytosis

2- Endocytosis

Endocytosis: Transporting substances to the cell through plasma membrane

How does Endocytosis take place

1- A part of plasma membrane bends to surround the particle forming a sac.

2- The sac containing the particle moves to cytoplasm.

→ If the solid substances enter the cell by means of endocytosis process, we call it **phagocytosis process**

→ If liquid substances enter the cell by means of Endocytosis process, we call it **pinocytosis process**.

Photosynthesis process

Photosynthesis process: A process by which green plant cells get energy required for the plant to perform its vital processes

Photosynthesis process takes place inside the chloroplasts of plant cells, where they change light energy to chemical energy. Photosynthesis process occur in two stages:-

1- First stage

1- Granum inside chloroplasts catch energy from sunlight by chlorophyll pigment

2- The plant use a part of energy to split water molecules to hydrogen and oxygen gases.

3- The leaves of plants release oxygen gas

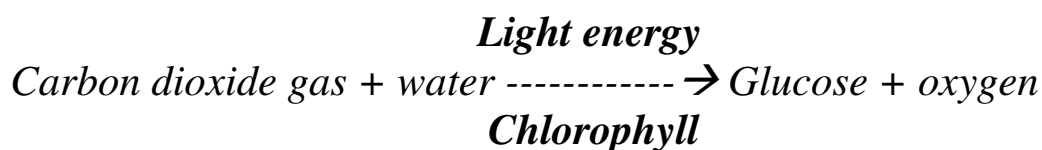
4- Stroma in chloroplasts store hydrogen gas

5- The rest of the energy is stored in the form of ATP compound

2- Second stage

It occurs in Stroma, where the energy stored in ATP is used to bind carbon dioxide gas and hydrogen gas together forming glucose sugar.

The equation of photosynthesis process:-



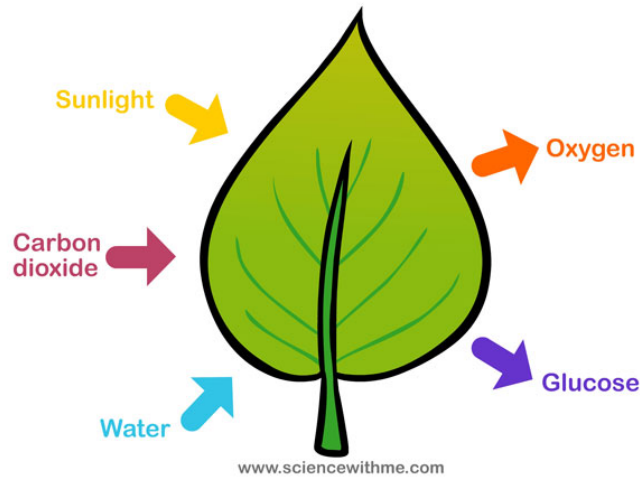


Fig. (39) Photosynthesis process

We can summarize photosynthesis process in the following points:-

- 1- Plants use light energy of sun to perform photosynthesis process*
- 2- Chloroplasts of plant cells absorb light energy*
- 3- A part of energy is used to split water molecules into hydrogen and oxygen gases*
- 4- Oxygen gas gets released from leaves, while hydrogen stays inside chloroplasts*
- 5- The rest of energy is used to bind carbon dioxide gas with hydrogen forming glucose sugar.*

Respiration and energy release

We studied in chapter (1) that energy is stored in glucose sugar. In order to release energy from it, cells break it into simpler molecules by oxidizing it.

Cell respiration: *Group of chemical reactions which occur inside cells to glucose in order to release the energy stored in it.*

Cell respiration occurs in two stages:-

First stage: *it occurs in cytoplasm releasing a small amount of energy.*

Second stage: *It occurs in mitochondria releasing a great amount of energy*

How cell respiration occurs:-

- 1- Glucose molecules break into carbon dioxide and water molecules*
- 2- Energy is stored in mitochondria in the form of ATP compound.*

(N.B: Cell respiration is a catabolic process - involves catabolism- because glucose molecules are broken into simpler ones to release energy)

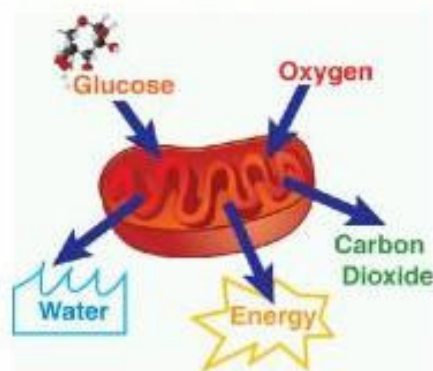


Fig. (40) Cell respiration (in mitochondria)

Science, Technology and Society

1- Stem cells

Stem cells: They are cells which have the ability to form any kind of specialized cells (muscle cells, liver cells, nerve cells...etc) according to certain conditions in laboratories.

Scientists discovered that these cells are formed during the early stages of fetus.

Importance of stem cells:-

They can be used to treat dangerous diseases, for example :-

- 1- Stem cells can be used to produce dopamine, which treats many diseases
- 2- They can be transplanted in the heart to form cardiac muscles instead of damaged ones.
- 3- They can form pancreas cells which secrete insulin to treat diabetes.



Fig. (41) Stem cells in the fetus

2- Cell fractionation

Cell fractionation: One of the new techniques which is used to study each kind of cells forming tissues, the structure, properties and locations of different cell organelles.

Importance of cell fractionation technique:-

- 1- Studying the kinds of cells forming different tissues
- 2- Studying the structure, properties and locations of different cell organelles.
- 3- Studying the vital processes occurring inside cells.

Cell fractionation technique depends on devices called **ultracentrifuges**.

Ultracentrifuge: It is a device used in cell fragmentation process, it is operated at different speeds to separate between the components of cells. It depends on the difference between the densities of cell components.



Fig. (42) Ultracentrifuge

Definitions of lesson (4)

Passive transport: The movement of substances through cell membrane where cell doesn't consume any energy.

Diffusion: The movement of molecules through membrane from a region of high concentration to a region of low concentration, which makes the concentration of molecules on both sides equal.

Osmosis: The movement of pure water molecules through a membrane from a region of low concentration to a region of high one, which makes the concentration of both sides equal.

Facilitated transport: The transport of molecules through a membrane by means of carrier protein (which carries molecules), where the cell doesn't consume any energy.

Bulk movement: Transporting relatively big molecules (such as wastes and protein particles) through cell membranes

Exocytosis: Transporting substances out of the cell through plasma membrane

Endocytosis: Transporting substances to the cell through plasma membrane

Phagocytosis: Transporting solid substances to the cell through plasma membrane

Pinocytosis: Transporting liquid substances to the cell through plasma membrane

Photosynthesis process: A process by which green plant cells get energy required for the plant to perform its vital processes

Cell respiration: Group of chemical reactions which occur inside cells to glucose in order to release the energy stored in it

Stem cells: They are cells which have the ability to form any kind of specialized cells (muscle cells, liver cells, nerve cells...etc) according to certain environmental conditions in laboratories.

Cell fractionation: One of the new techniques which is used to study each kind of cells forming different tissue, the structure, properties and locations of different cell organelles

Ultracentrifuge: It is a device used in cell fragmentation process, it is operated at different speeds to separate between the components of cells. It depends on the difference between the densities of cell components.

Give reasons for

1- When putting red blood cells in a solution with low concentration, they tear up and expand.

Because water molecules transport from the solution (low concentration) to red blood cells (high concentration) by osmosis process.

2- When putting red blood cell in a solution with high concentration, they shrink.

Because water molecules transport from red blood cells (low concentration) to the solution (high concentration) by osmosis process.

3- Active transport plays an important role in nerve cells

Because it allows the entrance of sodium and potassium ions to nerve cells which allow the transfer of nerve impulses to other body parts.

4- Active transport plays an important role in plant cells

Because it allows the root cells of plants absorb salts ions.

5- The biological importance of photosynthesis process to plants

Because plants use water, carbon dioxide gas and chlorophyll to form glucose in which energy is stored

6- The biological importance of cell respiration

Because cells break up glucose ions to carbon dioxide gas, water and energy (which is stored in the form of ATP compound in mitochondria)

7- Stem cells can be used in the treatment of various diseases

Because they can be used to form pancreatic cells which secrete insulin for diabetes patients, form cardiac tissues instead of damaged one to treat heart diseases, and produce dopamine substance which is used in the treatment of several diseases.

8- Cell fractionation is from the most important techniques in modern science.

Because it studies the cells of different tissues, the vital processes occurring inside living organisms, the structure, properties and locations of different cell organelles.

General test on chapter (2)

Answer four questions only

Question (1)

A- Choose the correct answer

1- Scientist stated that cells are produced from pre-existing ones.

A- Schleiden B- Virchow C- Robert Brown D- Charles Darwin

2-..... are plastids which are devoid of pigments

A- Leucoplasts B- Chromoplasts C- Chloroplasts D- Chromatin

3- The tissue which is responsible for transporting water and salts from roots to leaves.

A- Xylem B- Phloem C- Sclerenchyma D- Parenchyma

4- The cell walls of Sclerenchyma tissues cells are thickened with.....

A- Lignin B- Cellulose C- Chitin D- Glucose

5- microscope works by sunlight and artificial light.

A- Electronic B- Light C- Stereo D- Digital

B- Give reasons for:-

1- Active transport plays an important role in plant cells.

2- The importance of electronic microscope

3- Nucleus is the most important organelle in cell

4- Epithelial tissues line the small intestines of living organisms

Question (2)

A- Write the scientific term

1- The movement of pure water molecules through a membrane from a region of low concentration to a region of high one.

2- A living tissue composed of rectangular cells, its wall are not thickened with Lignin but with cellulose.

3- Coloured pigments which exist in chromoplasts

4- They synthesize proteins in the cell.

B- What happens if

1- Cells didn't have smooth endoplasmic reticulum

- 2- Putting red blood cells in a solution with low concentration
- 3- Muscle cells didn't have many mitochondria
- 4- Removing the nucleus from the cell.

Question (3)

A- Match

Group (A)	Group (B)
1- A thin membrane surrounding cytoplasm and controls the passage of substance to and from the cell	A- Golgi body
2- A kind of plant tissue which transports nutrients and water from roots to leaves	B- Plasma membrane
3- Thread- like structure which are composed of DNA combined with proteins	C- Green plastids
4- A group of flat membranous sacs with spherical ends which exists in great no. in glandular cells	D- Xylem
5- Cell organelles which exist only in plant cell and responsible for photosynthesis process	E- Chromosome
	F- Cell wall

B- Write short notes about

- 1- Prokaryotic cells
- 2- Stem cells
- 3- Cell respiration
- 4- Cell theory

Question (4)

A- Correct the underlined words

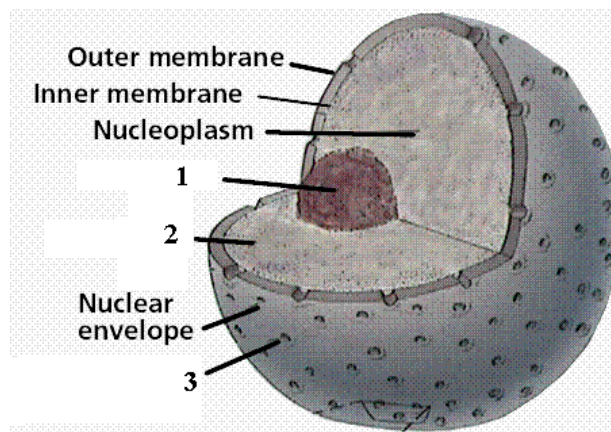
- 1- The part of cell which is responsible for synthesizing lipids is Lysosomes
- 2- Scientist Rudolf Virchow stated that all plants are composed of cells.
- 3- Collenchyma tissue is responsible for storing nutrients in cells
- 4- Mitochondria controls cell division process.

B- Compare between

- 1- Mitochondria and Lysosomes
- 2- Parenchyma and Collenchyma tissues
- 3- Epithelial and connective tissues
- 4- Electronic and light microscope

Question (5)

A- Study the following figure, and answer the questions



- 1- What is the name of this organ, what is its importance.
- 2- Label the previous diagram
- 3- What happens to structure (2) during cell division process?

B- Calculate the magnification power of a compound microscope, the magnification power of its objective lens equal 40x and that of its eyepiece equals 15x

Answers

Question (1)

A- Choose the correct answer

1- Virchow 2- Leucoplasts 3- Xylem 4- Lignin 5- Light

B- Give reasons for

- 1- Because it allows the cells of roots absorb the ions of salt, although the concentration of ions in the soil is greater than that of cells
- 2- Because it has a magnification power of one million x, as it uses beams of electrons instead of light; which gives clearer photos with higher differentiation
- 3- Because it controls all the biological processes in the cell (including cell division process), its nucleolus produces ribosomes which synthesize proteins, and it has the hereditary material of the cell in the form of chromatin reticulum.
- 4- In order to allow the small intestine absorb digested food and water

Question (2)

A- Write the scientific term

1- Osmosis 2- Collenchyma 3- Carotenoids 4- Ribosomes

B- What happens if:-

1- The cell wouldn't be able to synthesize lipids, change carbohydrates into glycogen, or decrease the toxicity of poisonous substances.

2- Water molecules would transport from the solution (low concentration) to red blood cells (high concentration), which makes them expand and tear up.

3- Muscle cells would work improperly because they lack energy.

Question (3)

A- Match

1-B 2-D 3- E 4- A 5- C

B- Write short notes about:-

1- Prokaryotic cells:-

They are primitive cells which are less complex than eukaryotic (developed) cells, they don't have many cellular organelles (such as plastids, mitochondria, Golgi bodies...etc). The hereditary material of those prokaryotes are not surrounded by nuclear membranes as eukaryotes are. Bacteria are example on prokaryotes

2- Stem cells :-

They are cells which can form different types of specialized cells (cardiac cells, nerve cells, skin cells...etc). These cells are formed in the early stages of fetus. Scientists seek to used them in the treatment of diseases, as stem cells can be used to produce dopamine substance (which cure many diseases), they can form pancreatic cells that secret insulin to treat diabetes patients and heart tissues instead of damaged one to treat heart diseases.

3- Cell respiration

A group of chemical reactions that occur inside mitochondria to release energy from glucose molecules. Glucose molecules are broken into carbon dioxide, water and energy (which is stored in the form of ATP compound)

4- Cell theory

Cell theory is one of the most important theories in modern science, it states that all organisms are composed of one or more cells, cells are produced from pre-existing ones and cell is the structural and functional unit of living organisms.

Question (3)

A- Correct the underlined words

1- Ribosomes 2- Schleiden 3- Parenchyma tissue 4- Nucleus

B- Compare between

<i>Mitochondria</i>	<i>Lysosomes</i>
<ul style="list-style-type: none">- They store respiration enzymes in cell- They store substances which contain energy.- They store energy in the form of ATP	<ul style="list-style-type: none">- They contain digestive enzymes which help in digesting nutrients and getting ride of wasters.

<i>Parenchyma tissue</i>	<i>Collenchyma tissue</i>
<ul style="list-style-type: none">- living tissue which is composed of spherical or ellipsoidal cells with thin and flexible walls.- It stores nutrients, perform photosynthesis and aeration processes.	<ul style="list-style-type: none">- Living tissue which is composed of semi-rectangular cells whose wall are thickened with cellulose- They support the plant and protect its inner tissues.

<i>Epithelial tissues</i>	<i>Connective tissues</i>
<ul style="list-style-type: none">- They are tissues which cover the outer surface of the body and line its cavity- They consist of a great number of attached cells with little intracellular substances between them	<ul style="list-style-type: none">- they are tissues which connect between the tissues and organs of body, transport liquids inside it , or support the body- They are composed of relatively distant cells, the intracellular spaces between them are filled by liquid, semi-solid, or solid substances

<i>Electronic microscope</i>	<i>Light microscope</i>
<ul style="list-style-type: none">- It has a magnification power of one million x (1000000)- It depends on beams of electrons controlled by electromagnetic lenses	<ul style="list-style-type: none">- It has a magnification power of 1500 times- It depends in its works on sunlight or artificial light.

Question (5)

A- The diagram

1- Label

Name: Nucleus

Importance: Control vital processes inside the cell (including cell division process) – contains the hereditary material of cell – contains nucleolus which forms ribosomes which synthesize proteins.

2- Label the diagram

1- Nucleolus

2- Chromatin reticulum

3- Nuclear pore

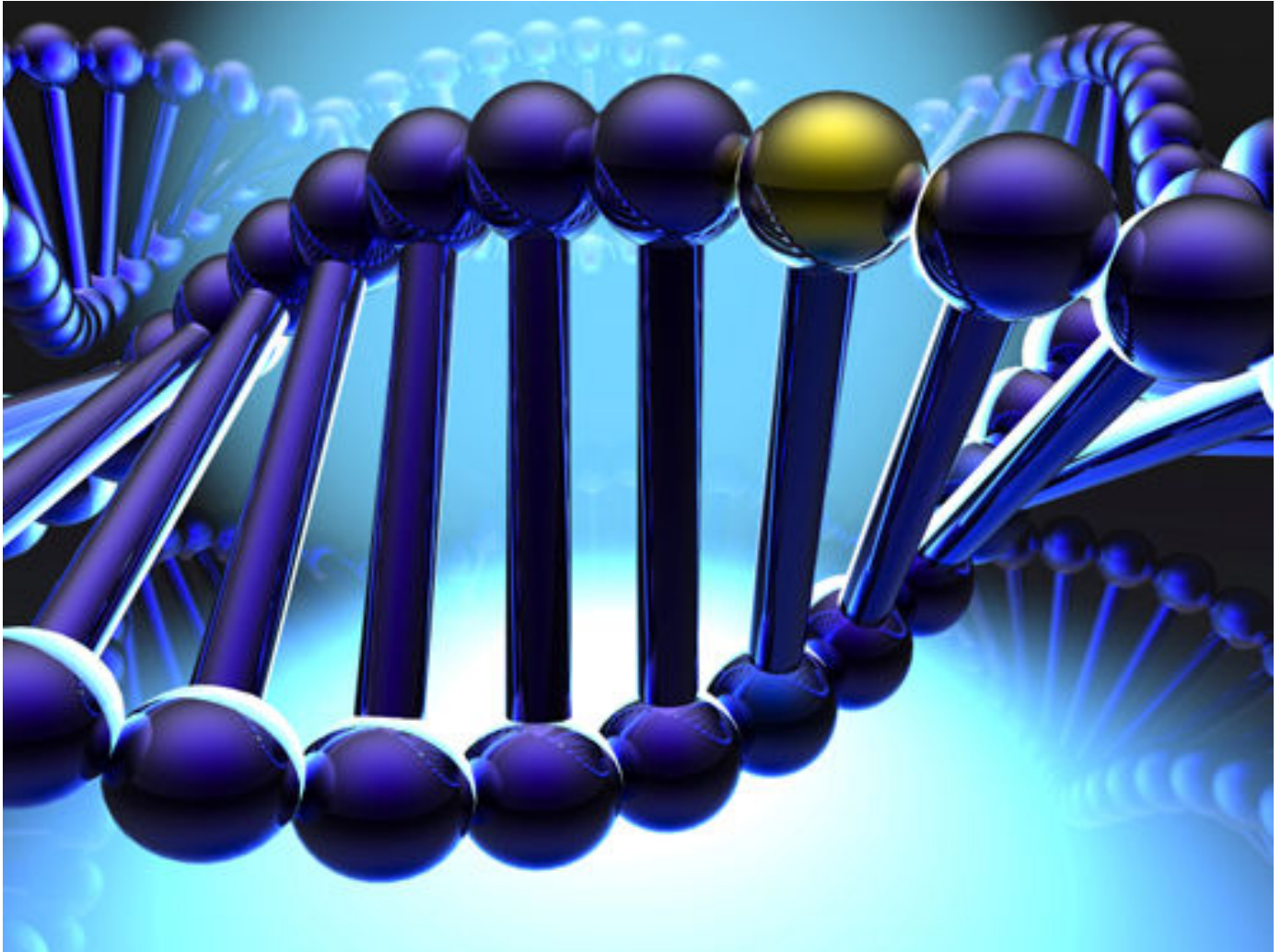
3- It condenses forming thread-like structure called chromosomes, which are two chromatids attaching to each other at a point called centromere, chromosomes appear at Metaphase stage of cell division.

2- The problem

The magnification power = magnification power of eyepiece x that of objective lens = 15 x 40 = 600x

Chapter (3) Inheritance of traits

Lesson (1) Chromosomes and genetic information



→ In early 20th century, scientists discovered that genetic information is carried on chromosomes, this genetic information causes the appearance of hereditary traits in living organisms.

→ Chromosomes exist inside cell nucleus, they are found in the form of homologous pairs in somatic and reproductive cells.

Karyotype

Karyotype: The arrangement of chromosomes of cell nucleus in descending order according to their size and number.

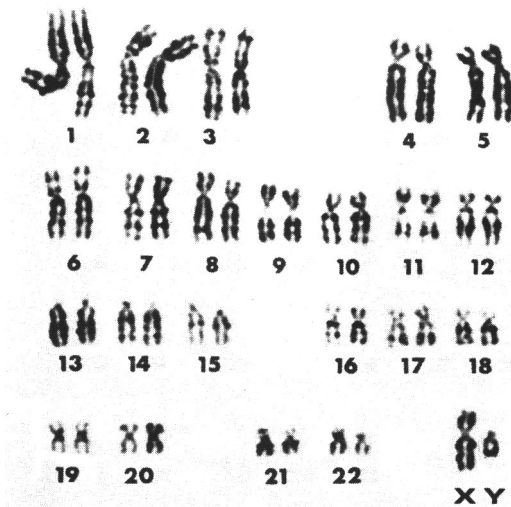


Fig. (1) Karyotype of human male

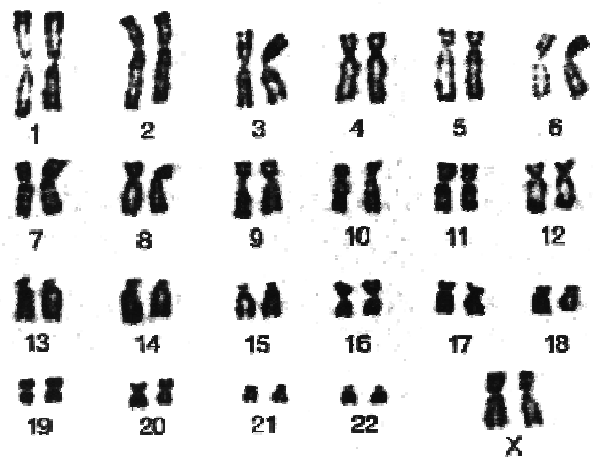


Fig. (2) Karyotype of human female

Number of chromosomes:-

→ Living organisms have different numbers of chromosomes, while members of the same species have the same number of chromosomes.

Somatic cells: Each somatic cell has two pairs of homologous chromosomes (one pair is inherited from father while the other from mother). They are called **diploid cells (2n)**

Reproductive cells (gametes) (sperms – ova – pollen grains): Each gamete has one pair of chromosomes. A gamete has half the number of chromosomes of somatic cell. Gametes are known as **haploid cells (n)**

→ In human, nucleus of each somatic cell contains 46 chromosomes (23 pairs), while that of each gamete cell contains only 23 chromosomes.

→ Chromosomes pairs are arranged in **descending order** according to their sizes from number (1) to number (23)

→ Chromosomes pairs from (1) to (22) are known as **somatic chromosomes**

→ Chromosomes pair (23) is called **sex chromosomes** because this pair carries the genetic information responsible for the determination of sex (male or female).

→ Sex chromosomes pair follows pair (7) in size, but its order is (23)

Karyotype in male:-

Sex chromosomes pair in male is non homologous (XY) (See fig (1))

Karyotype in female:-

Sex chromosomes pair in female is homologous (XX) (See fig (2))

(N.B: The constant number of chromosomes in all members of human kind proved that chromosomes carry genetic information responsible for the appearance of hereditary traits)

Species	Number of chromosomes
Human	46
Chicken	32
Cat	38
Drosophila	8
Dog	78
Tobacco	48
Gorilla	48
Onion	16
Potato	48
Peas	14
Frog	26
Wheat	48

Chromosome Theory

→ Scientists Boveri and Sutton put chromosome theory in 1902, which states that:-

- 1- Chromosomes exist in somatic cells in the form of homologous pairs ($2n$)
- 2- Gametes contain half the no. of chromosomes in somatic cells as a result of meiotic cell division; where homologous pairs get separated from each other forming two identical groups
- 3- Each pair of chromosomes acts independently when being transferred to gametes.
- 4- After fertilization process, the normal number of chromosomes ($2n$) comes back

5- Each chromosome carries hundreds of genes.

→ A chromosome is made of DNA and protein, DNA carries genes which have the genetic information of living organisms

→ A gene consists of a series of nucleotides, it forms protein codes which are responsible for the appearance of traits in living organisms.

Remember

Fertilization: The fusion of male gamete (n) with female gamete (n) forming zygote of complete number of chromosomes ($2n$)

Mendel's laws in light of chromosome theory

Remember

Mendel's second law (law of independent assortment of hereditary factors):
When two individuals bearing one or more contrasting pairs of hereditary factors copulate, each factor is inherited independently of the other factors.

We studied in 3rd prep that :-

- In Meiotic cell division, genes separate from each other forming gametes, but they meet again after fertilization process forming zygote of ($2n$) of chromosomes.
- Dominant trait appears in all members of 1st generation at ratio 100%
- Dominant and recessive traits appear in members of 2nd generation at ratio 3 dominant : 1 recessive

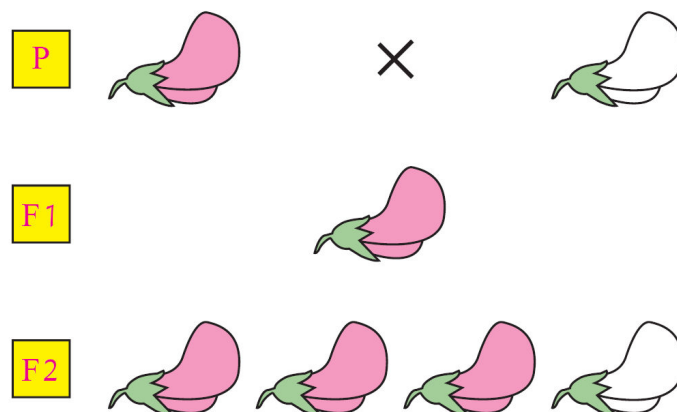


Fig. (3) The appearance of pink roses (dominant) and white rose (recessive)

→ When two individuals bearing one or more pairs of contrasting genes copulate, every gene is inherited independently of the others.

→ The assortment (distribution) of genes in gametes is independent because every gene exists on an independent chromosome.

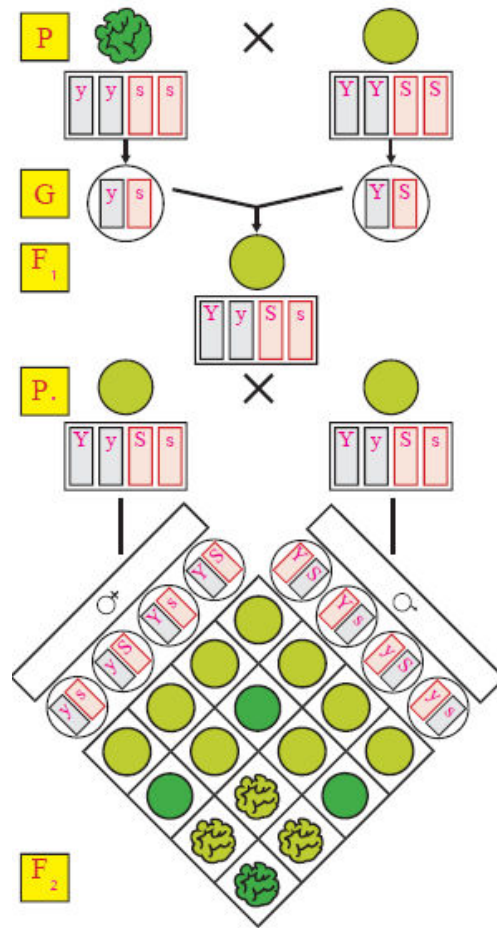


Fig. (4) Independent assortment of genes

We conclude from the previous figure that:-

- Yellow colour and smooth shape of pea are from dominant traits
- Green colour and sinuous shape of pea are from recessive traits
- Each gene of each hereditary trait is inherited independently of the others
- 100% of the Individuals of 1st generation are yellow-coloured and smooth-shaped
- Individuals of second generation have ratio of 1 : 3 : 3 : 9

Linkage and crossing over

Scientist **Thomas Morgan** discovered in 1911 while studying the inheritance of traits in drosophila insect (fruit fly) that:-

- Genes of Drosophila exist on only four pairs of chromosomes.
- Each chromosome pair carries hundreds of genes
- Genes on the same chromosome are inherited as a single unit

→ This contradicts with Mendel's second law of the independent assortment of hereditary factors because Mendel's law states that hereditary factors (genes) are

inherited independently of the other factors, while Thomas Morgan supposed that genes on the same chromosome are inherited as a single unit

→ This means that Mendel's second law is not a general law.

→ Morgan supposed that the linkage of genes with each other is because they exist on the same chromosome. He also supposed that the linkage force between linked genes depends on the distances between them.

Types of linkage between genes:-

It depends on the distances between genes, there are two types of linkage.

1- Complete linkage

Linkage in which two genes - on the same chromosome - are so close to each other that they cannot get separated.

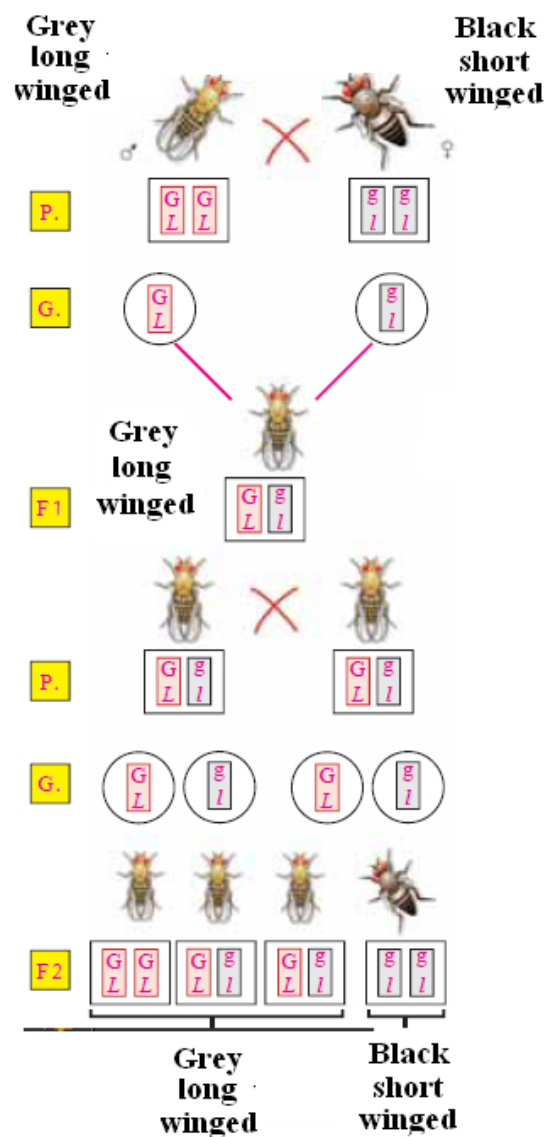


Fig. (5) Complete linkage in *Drosophila*

→ In the previous figure, we'll find that genes **G** and **L** are inherited as single unit and didn't separate (as Mendel's second law states)

→ Complete linkage causes the constancy of genes, and hence the constancy of the inheritance of hereditary traits

2- Incomplete linkage

→ In some cases, genes on the same chromosome don't stay linked together forever.

→ Genes on the same chromosome separate from each other and get exchanged with genes of another chromosome during meiotic cell division; which causes the appearance of new traits in the offspring. This phenomenon is called "crossing over"

Crossing over:-

→ It occurs during Prophase I stage of meiosis

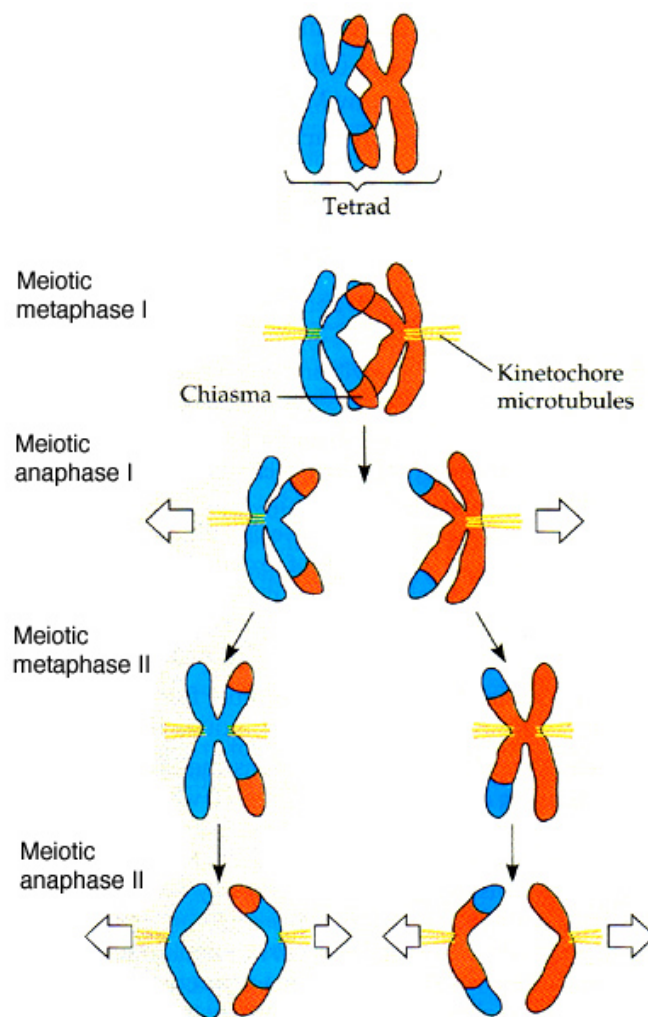


Fig. (6) Crossing over phenomena

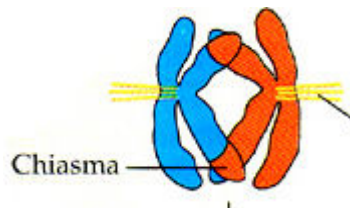
Prophase stage I

→ Homologous chromosomes approach to each other forming **Tetrad**, which consists of 4 chromatids.



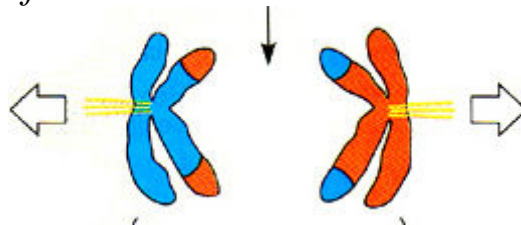
→ The internal chromatids of homologous chromosomes pairs coil around each other (cross-over) at one or more points called **Chiasma**, where the breakage takes place.

→ The internal parts of intertwined chromatids of homologous chromosomes pairs are exchanged, which is known as **Crossing over**



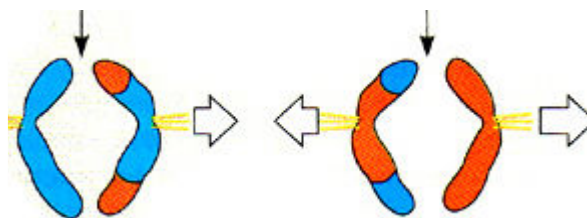
Anaphase I stage

→ Pairs of homologous chromosomes separate from each other after crossing over forming two groups of chromosomes.



Anaphase II stage

→ Chromatids get separated from each other, they are called "building chromosomes". Then, they are distributed randomly among gametes.



→ Chromatids which underwent crossing over are called "**New chromosomes**". While chromatids which didn't undergo crossing over are called "**Parental chromosomes**". Thus, gametes contain new and parental chromosomes

→ Crossing over is an incomplete linkage of genes which causes the change of hereditary traits with certain ratios

→ Chances of crossing over occurrence increase by the increase of the distance between genes.

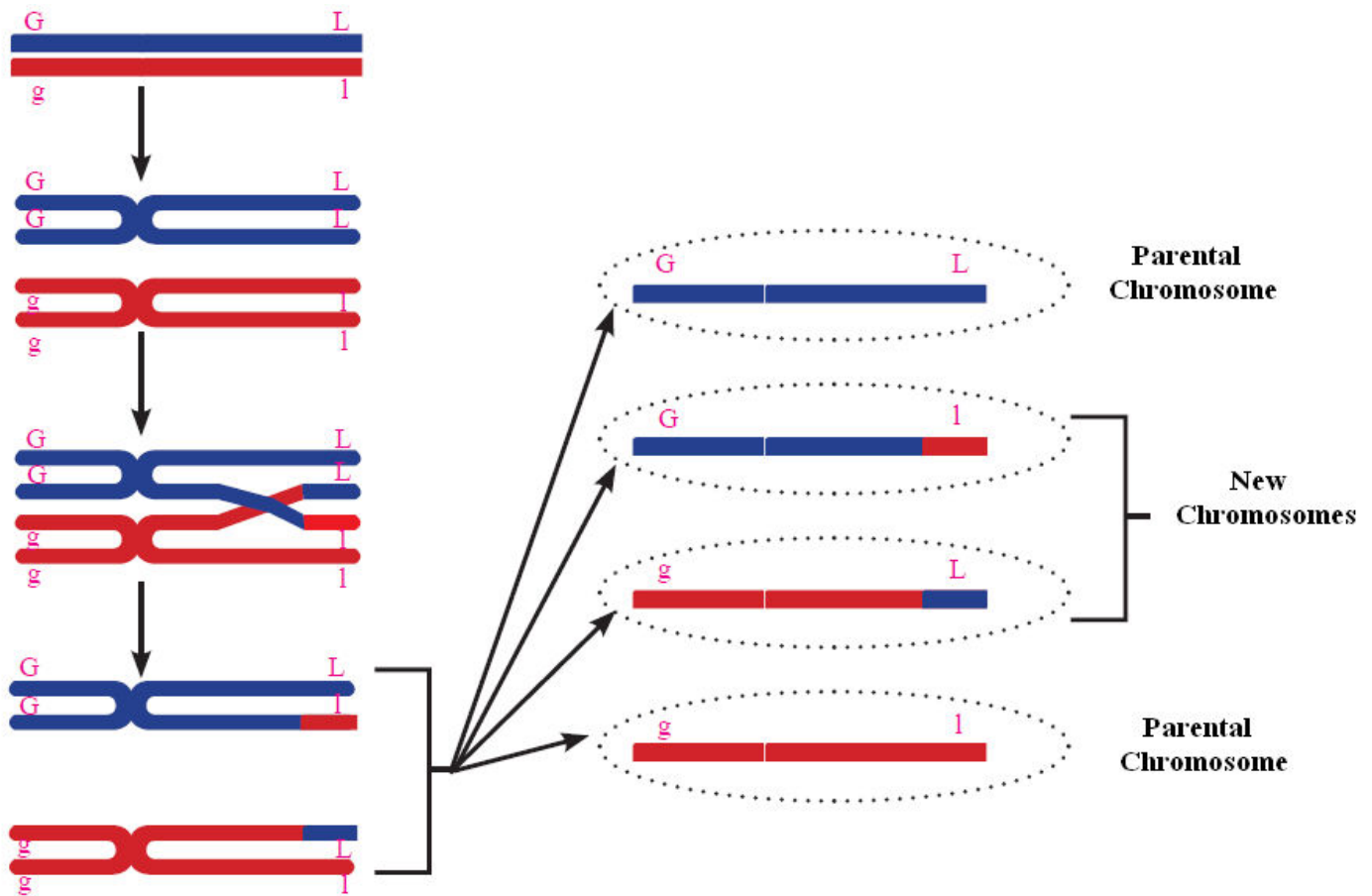


Fig. (7) Crossing over and chromosomes

→ In the previous figure, the two new chromosomes are (GL) and (gl), crossing over result in the formation of 4 chromatids, which are:-

(GL) → Parental chromosome

(Gl) → New chromosome

(gl) → Parental chromosome

(gL) → New chromosome

Importance of crossing over:-

It causes the variation of hereditary traits of the members of same species, which helps them in the adaptation with environment conditions, and the development and continuation of their life

Chromosomal maps

→ Scientists could identify the locations of genes on chromosomes by studying the ratios of crossing over phenomenon, which is known as **Chromosomal maps**.

Definitions of lesson (1)

Karyotype: The arrangement of chromosomes in cells in descending order according to their size and number.

Chiasma: The points of connection of internal chromatids in homologous chromosomes pairs.

Crossing over: The exchange of parts of internal chromatids of homologous chromosomes pairs.

Give reasons for

1- Chromosomes pair (23) is called sex chromosomes

Because this pair carries the genetic information responsible for the determination of sex (male or female).

2- The assortment (distribution) of genes in gametes is independent according to Mendel's second law

Because every gene exists on an independent chromosome

3- Thomas Morgan's hypothesis on inheritance contradicts with Mendel's second law of the independent assortment of hereditary factors

Because Mendel's law states that hereditary factors (genes) are inherited independently of the other factors, while Thomas Morgan supposed that genes on the same chromosome are inherited as a single unit.

4- The importance of crossing over phenomenon

Because it causes the variation of hereditary traits of the members of same species, which helps them in the adaptation with environment conditions, and the development and continuation of their life.

Questions

1- Choose the correct answer

1- In human, nucleus of each somatic cell contains pairs of chromosomes

A- 23 B- 46 C- 37 D- 15

2- In human, nucleus of each somatic cell contains of chromosomes

A- 46 B- 37 C- 23 D- 18

3- Chromosomes pair number is called sex chromosomes.

A- 15 B- 17 C- 9 D- 23

4- Sex chromosomes pair in male is

A- XX B- XY C- YY D- XXY

5- Sex chromosomes pair in female is

A- XX B- XY C- YY D- XXY

6- Scientist/s discovered that genes on the same chromosomes are not inherited independently, but as single unit.

A- Gregory Mendel B- Boveri and Sutton C- Thomas Morgan D- Darwin

7- Scientist/s formulated the chromosomal theory.

A- Boveri and Sutton B- Thomas Morgan C- Mendel D- Leeuwenhoek

8- Homologous chromosomes approach to each other forming tetrad in stage of meiosis

A- Prophase I B- Prophase II C- Anaphase I D- Anaphase II

9- The points of connection of internal chromatids in homologous chromosomes pairs is called

A- Chiasma B- Chromosome C- Centromere D- Centrosome

10- In gametes, chromosomes which didn't undergo crossing over are called

A- New chromosomes B- Building chromosomes C- Parental chromosomes
D- Chromatids

2- Write the scientific term

1- The arrangement of chromosomes in cells in descending order according to their size and number.

2- The points of connection of internal chromatids in homologous chromosomes pairs.

3- The exchange of parts of internal chromatids of homologous chromosomes pairs with their genes.

4- Chromosomes which didn't undergo cross over in gamete cells during meiosis.

5- Chromosomes which didn't undergo cross over in gamete cells during meiosis.

3- Write one work of each one of the following scientists

1- Boveri and Sutton

2- Thomas Morgan

4- Write short notes about

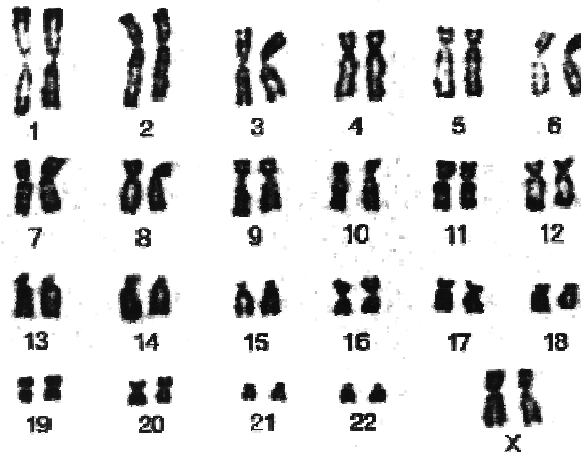
1- Chromosomal theory

2- Chromosomal maps

3- Complete linkage

4- Karyotype

5- The following figure describe Karyotype of a cell, answer the questions

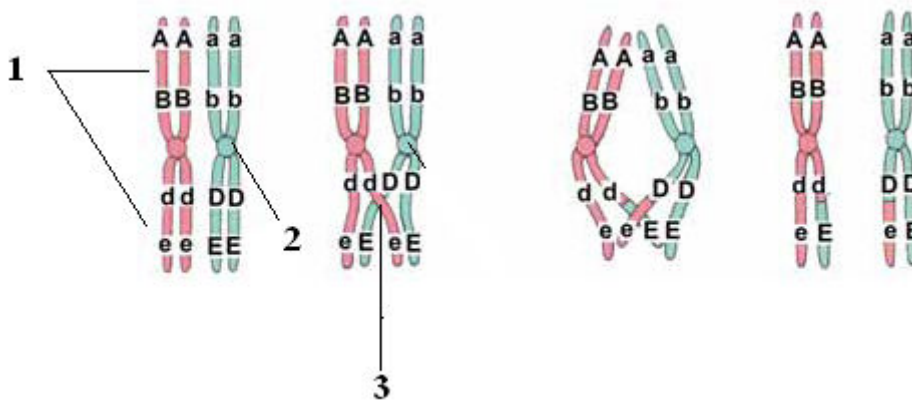


1- What does this Karyotype describe, a somatic cell or gamete? Why?

2- What is the sex of the person carrying this Karyotype ? Why?

3- What is the number of somatic and sex chromosomes?

6- The following figure describe a very important phenomenon



1- What is the name of this phenomenon, when does it happen?

2- Label the numbers (1), (2), (3)

3- Mention the genotypes of gametes resulted from this phenomenon.

The Answers

1- Choose the correct answer

1- 23

6- Thomas Morgan

2- 46

7- Boveri and Sutton

- | | |
|-------|-------------------------|
| 3- 23 | 8- Prophase I |
| 4- XY | 9- Chiasma |
| 5- XX | 10- Parental chromosome |

2- Write the scientific term

- | | |
|------------------|-------------------------|
| 1- Karyotype | 4- Parental chromosomes |
| 2- Chiasma | 5- New chromosomes |
| 3- Crossing over | |

3- Write one work of each one of the following scientists

- 1- **Boveri and Sutton:** They put chromosomal theory in 1902
- 2- **Thomas Morgan:** He noticed while studying *Drosophila* in 1911 that genes on the same chromosome are inherited as one unit not independently

4- Write short notes about

- 1- See page (3)
- 2- See page (9)
- 3- See page (6)
- 4- See page (2)

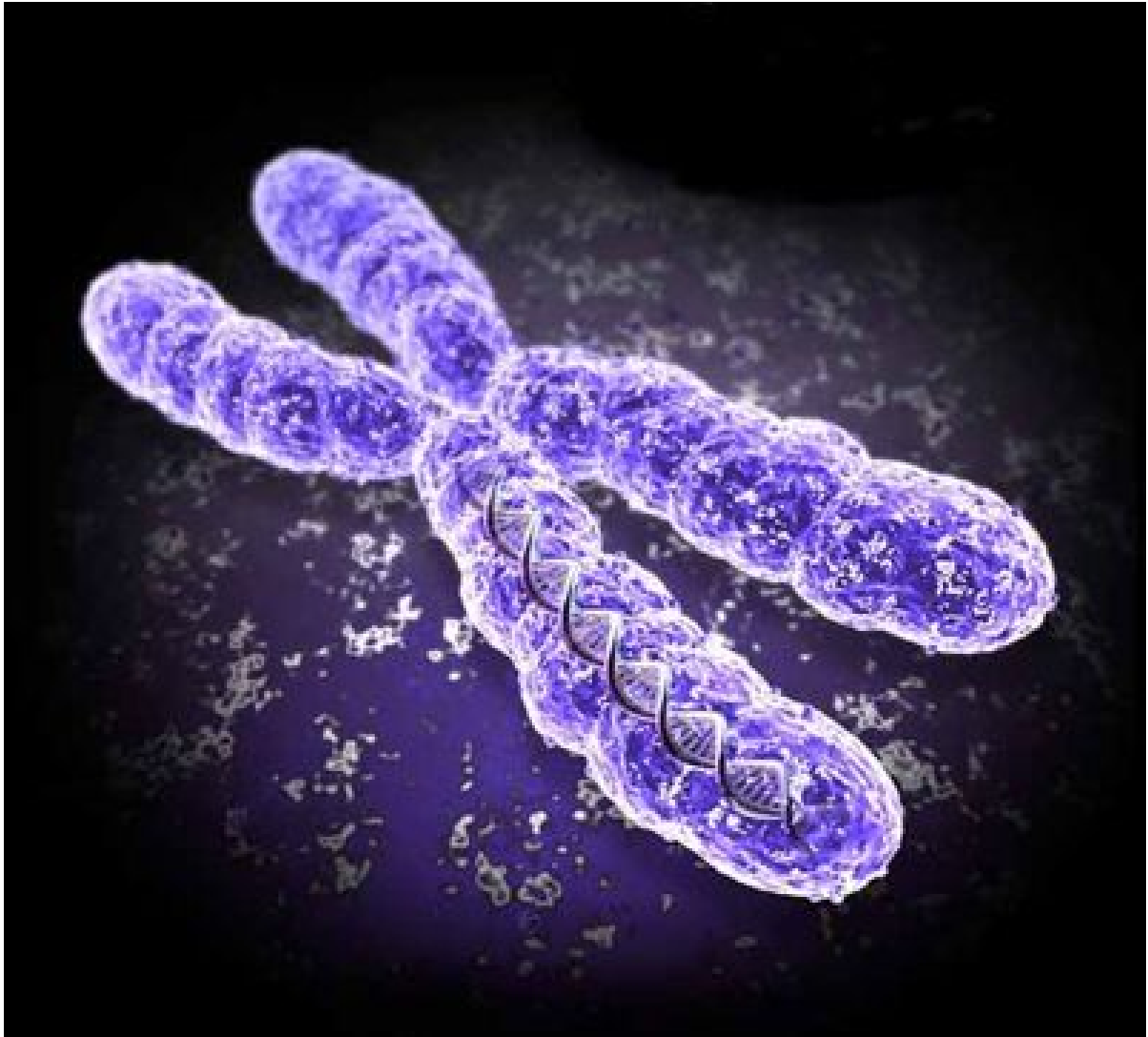
5- The following figure describe Karyotype of a cell, answer the questions

- 1- Somatic cell, because it contains 23 pairs of chromosomes (diploid cell $2n$)
- 2- Female, its sex chromosome is homologous (XX)
- 3- Somatic chromosomes: 44 (22 pairs) Sex chromosomes: 2 (1 pair)

6- The following figure describe a very important phenomenon

- 1- Crossing over, prophase I of meiosis
- 2- (1) Chromatid (2) Centromere (3) Chiasmus
- 3- (ABde) (ABdE) (abDe) (abDE)

Lesson (2)
The interaction of genes



→ In 1860, Scientist Gregory Mendel discovered that every hereditary trait is controlled by a pair of genes, which may be dominant or recessive

Remember

Dominant trait: Trait which appears in all members of 1st generation

Recessive trait: Trait which disappears in all members of 1st generation and appears in 2nd generation at ratio 25%

→ Scientists discovered that there are many traits which are not inherited according to Mendel's laws, they are called **Non-Mendilian traits**. There are some cases of non-Mendilian traits in which the appearance of hereditary traits is affected by the interaction of genes.

→ **Examples of genes interaction:** Lack of dominance – Complementary genes – Lethal genes.

Remember

→ Each pair of contrasting traits is called "Allelomorphic traits"

→ According to Mendel, when two pure individuals (one of them carries a dominant trait, while the other carries recessive trait) copulate, Only the dominant trait appears in the individuals of 1st generation, while it appears with recessive trait in the individuals of 2nd generation at ratio 3 dominant : 1 recessive

First: Lack of dominance

→ Flowers of **Four o'clock plants** have three colours: **Red** – White – **Pink**



Fig. (1) Four o'clock plant

→ When a plant with white flowers (WW) copulates with another one of red flowers (RR), they produce 100% plants with pink flowers (RW) in the first generation.

→ In 2nd generation, red, pink and white flowers appear at ratio 1:2:1

We conclude from the following figure:-

→ The colour of flower trait (Red or white) is controlled by two genes which do not dominate over each other.

→ Those two gene interact together, and every opposite gene participates in the formation of a new trait (RW).

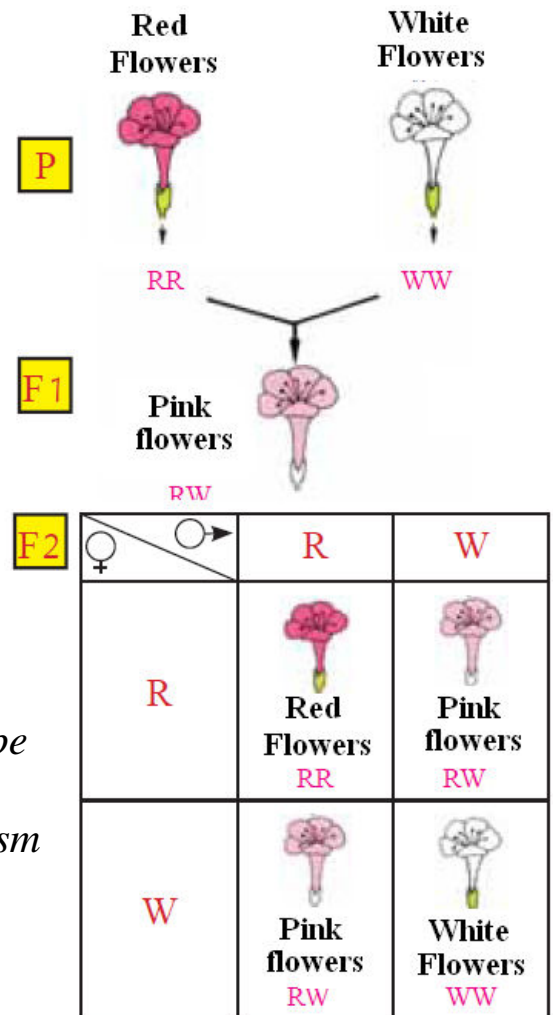
→ These results contradict with Mendel's laws because no hereditary factor (gene) dominates over the other one, which forms plants of ratio 1:2:1 instead of 1:3 in the 2nd generation. But the two genes interact forming new gene, which is known as **lack of dominance**

→ **Note:** in lack of dominance case, the phenotype describe genotype

Genotype: The structure of gene in living organism

Phenotype: The hereditary trait appearing on Living organism.

The gene responsible for eye colour is genotype, While the colour of eye trait is phenotype



Red : Pink : White

25% : 50% : 25%

1 : 2 : 1

Inheritance of blood groups in human

Although the components of blood are constant in all humans, they have different blood groups

→ Blood transfusion process depends on **blood group** and **kind of Rhesus factor**

→ **Blood groups trait** is controlled by three kinds of genes called **Alleles**, these alleles are denoted by (A – B – O). Each person inherits only one pair of Alleles.

→ This pair of alleles exist on **chromosome pair (9)** in all humans.

Allele (For illustration only) : Alternative forms of the same gene which produce different effects.

Genetic classification of blood groups

Blood groups share three inheritance types, which are:-

- Alleles multiplicity:-

→ Blood groups trait is controlled by 3 alleles (A – B – O)

→ Human inherits only one pair of them

Blood group	Genotype (genetic structure)
A	AA or AO
B	BB or BO
AB	AB
O	OO

- Complete dominance: Both of genes (A) and (B) dominate over gene (O)

- Lack of dominance: There is no dominance between genes (A) and (B), but they participate in the formation of a new group (AB)

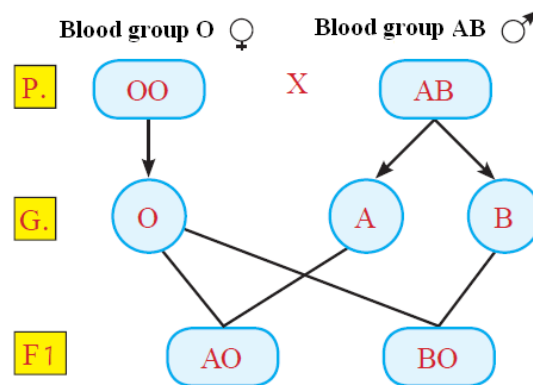


Fig. (2) Blood group inheritance

→ From the previous figure, we conclude that 50% of children will have blood group (A), and the other 50% will have blood group (B)

Chemical classification of blood groups:-

Blood groups (A – B – AB – O) classification depends on the kind of two substances in blood, which are:-

Antigens:-

They are chemical substances which exist on the surface of red blood cells (RBC), they have two kinds:-

1- Antigens a

2- Antigens b

Antibodies:-

They are antibodies of antigens which exist in blood plasma, they have two kinds:-

1- anti-a

2- anti-b

Blood Group	Antigens	Anti Bodies
A	a	anti-b
B	b	anti-a
AB	a - b	-----
O	-----	anti-a anti-b

The importance of blood groups

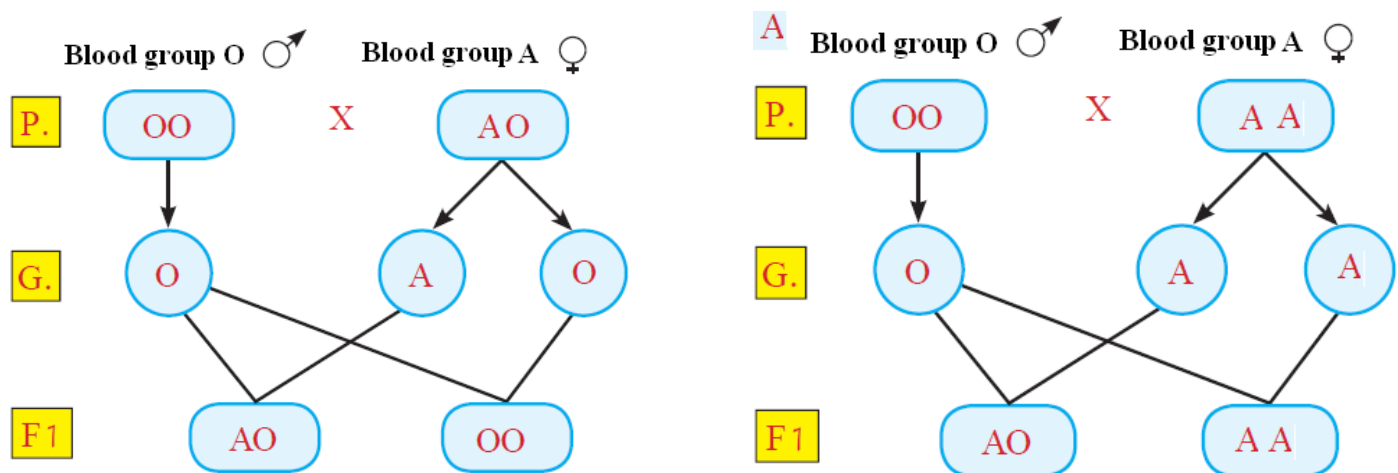
- 1- Solving problems of the determination of paternity (parents of children) and pedigree of children (blood groups deny pedigree but don't prove it)
- 2- Determination of blood transfusion processes between individuals.
- 3- Used in the study of human races classification and evolution

Example

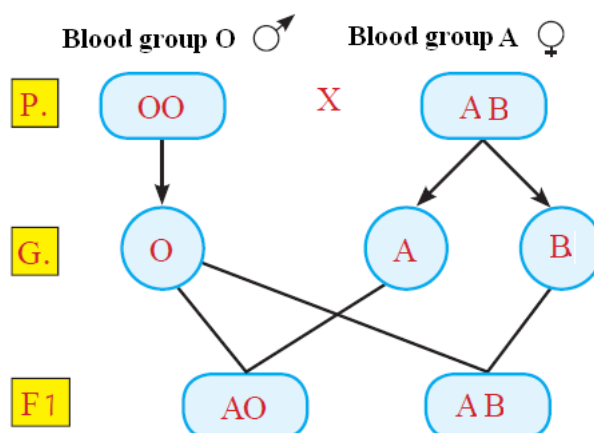
Two fathers argued about the pedigree of a child of blood type (O), if the blood types of both fathers is (O), the blood type of first man's wife is (A), and the second's wife (AB). Which one of those men is more likely to be the father of the child? Why?

Solution

→ Genetic analysis of the first man and his wife (N.B: genotype of blood type (A) is (AO) or (AA) – Genotype of blood type (O) is (OO))



→ Genetic analysis of the second man and his wife (N.B: genotype of blood type (AB) is (AB) – genotype of blood type (O) is (OO))



→ Therefore, the man who is married to the woman having (A) blood group is the father of the child

Blood transfusion process

Blood can be transfused between different blood groups according to the antigens and antibodies.

→ The following table describes blood groups and the probability of transfusing blood between them.

Blood Group	Genotype		Antigens	Antibodies		Gives blood to	Receives blood from
A	AO	AA	a	anti-b		A , AB	A , O
B	BO	BB	b	anti-a		B , AB	B , O
AB	AB		a-b	-----		AB	All blood groups
O	OO		-----	anti-a	anti-b	All blood groups	O

From the previous table, we conclude that:-

→ Blood group (AB) is called **Universal Recipient** because it can receive blood from all groups, as it doesn't have any antibodies.

→ Blood group (O) is called **Universal Donor** because it can give blood to all groups, as it doesn't have any antigens.

Determination of blood types

→ We said that antigens have antibodies (Ex. Antigen a has antibody a)

→ We can determine the type of blood by the reactions which occur between antigens and antibodies and the occurrence of blood coagulation (clotting)

Steps of determining blood type

- 1- Sample of blood is taken from the person.
- 2- We put two drops of blood on two clean glass sheets
- 3- We add (anti-a) antibodies to the first blood drop and (anti-b) antibodies to the second one.
- 4- We compare the result to the following table

First blood drop (anti-a)	Second blood drop (anti-b)	Blood type
- Coagulation (+)	- No coagulation (-)	A
- No coagulation (-)	- Coagulation (+)	B
- Coagulation (+)	- Coagulation (+)	AB
- No coagulation (-)	- No coagulation (-)	O

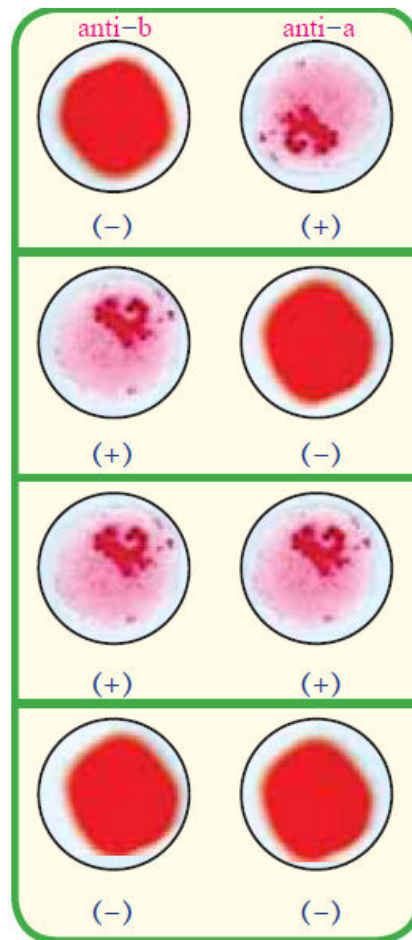


Fig. (3) Blood coagulation and blood group

Possible risks of blood transfusion

There are some risks which the recipient (who takes blood) may be exposed to:-

1- When a person receives blood which is not suitable for its type, some symptoms appear on him, such as :-

- Shivering in body
- Chest pain
- Blueness
- irregular heartbeat
- low blood pressure
- Shortness of breath
- Headache

This usually ends with the death of the person

2- Polluted blood may be transfused to the recipient person, which causes the infection with viruses (Ex. Hepatitis b virus – AIDS virus)

→ So, blood is being examined before transfusion process in order to make sure it is suitable for the recipient blood, and doesn't carry any pathogenic (disease-causing) organisms

Rhesus factor (Rh)

→ Blood carries two kinds of antigens, which are:-

- Antigens of blood group (a – b)
- Rhesus factor antigens

→ 85% of humans have rhesus factor antigens in their blood, they are denoted by (Rh+) – positive rhesus factor

→ 15% of humans don't have rhesus factor antigens in their blood, they are denoted by (Rh-) – negative rhesus factor

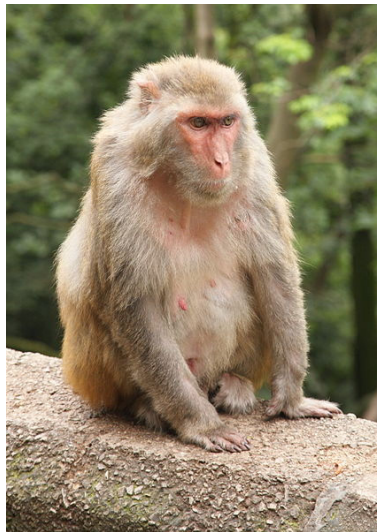
→ The inheritance of rhesus factors antigens is controlled by three pairs of genes carried on one chromosome pair.

→ A person becomes positive Rh factor (Rh+) if it has one or more dominant genes in each pair, while it becomes negative Rh factor (Rh-) if all its genes are recessive

For illustration only

→ Rhesus factor was discovered in 1940 in "Rhesus monkeys" species

→ Rhesus monkeys are native to southeast, central and south Asia



The importance of rhesus factor:-

We should determine rhesus factor in blood before blood transfusion process and marriage; in order to prevent the formation of antibodies of rhesus factor antigens, which breaks red blood cells.

Rhesus factor role in pregnancy

→ If a (Rh+) man married a (Rh-) woman, and the fetus inside uterus of woman is (Rh+) like his father, a part of the fetus blood mix with that of mother.

→ Immune system of pregnant mother produces antibodies of Rh factors antigens.

→ If mother becomes pregnant with another baby, antibodies (which were produced from pregnancy of the first fetus) transfer from mother to her second fetus through placenta, which breaks its red blood cells causing acute anemia to him, which may lead to its death.

Protective procedure:-

If we discovered the difference of Rh factor in mother right before delivery, we give her vaccine within 72 hours after every delivery in order to protect the next fetus. This vaccine breaks the amount of blood mother had taken from her fetus (which contains Rh+) before her immune system forms antibodies of Rh antigens.

Complementary genes

Complementary genes: Genes which interact with each other causing the appearance of a hereditary trait

→ The inheritance of complementary trait is controlled by two pairs of genes.

→ Dominant trait appears if every pair of genes has a least one dominant gene. Otherwise, opposite recessive trait will appear.

Flowers colours of sweet pea plant

The inheritance of flower colour trait in sweet pea plant is an example of complementary genes.

→ Pink colour of flower is the dominant trait, while white colour of flower is the recessive trait

→ Colour trait is controlled by two pairs of genes, dominant genes are denoted by (A) and (B), while recessive genes are denoted by (a) and (b)



Fig. (4) Pink flower of sweet pea plant (Dominant trait)

→ When two white flowers ($AA\ bb$) copulate, 100% pink flowers are produced in the first generation, while both pink and white flowers appear in the second generation at ratio 9:7

→ The appearance of pink colour (dominant trait) in sweet pea flowers depends on the aggregation of one or more dominant genes in each pair because both dominant genes participate in the formation of pink colour, as each gene controls the production of certain enzyme influencing the formation of pink colour.

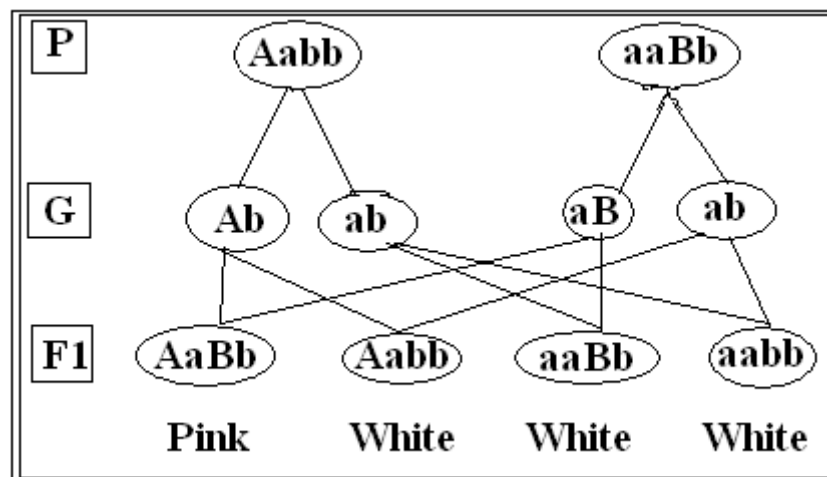
→ This example proves the complementation of genes, as we can get the dominant trait from two fathers each one of them carries the recessive trait.

→ The ratio of 2nd generation according to Mendel's second law is 1:3:3:9, while that according to complementary genes (non-Mendilian traits) is 7:9

Example (1)

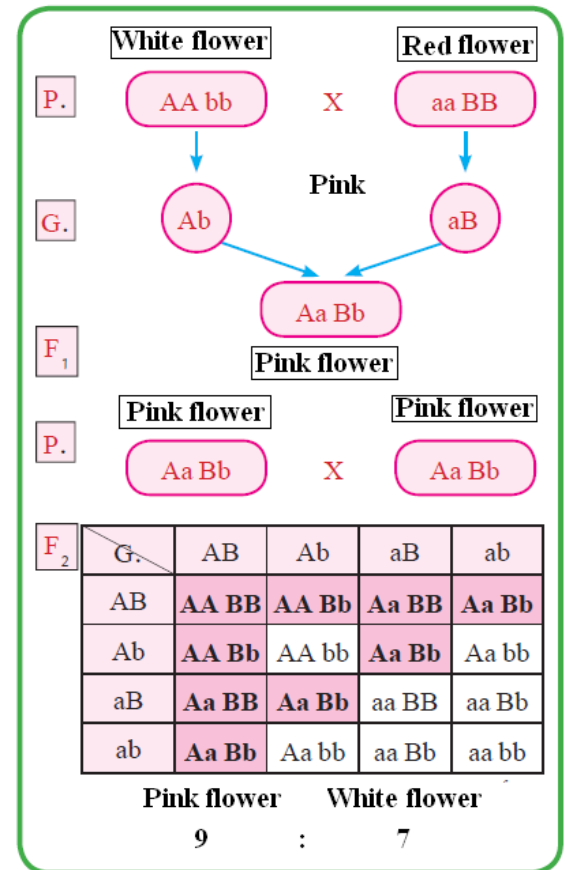
Determine the phenotypes and genotypes of the colour of flowers produced from the copulation ($Aabb \times aaBb$)

Solution

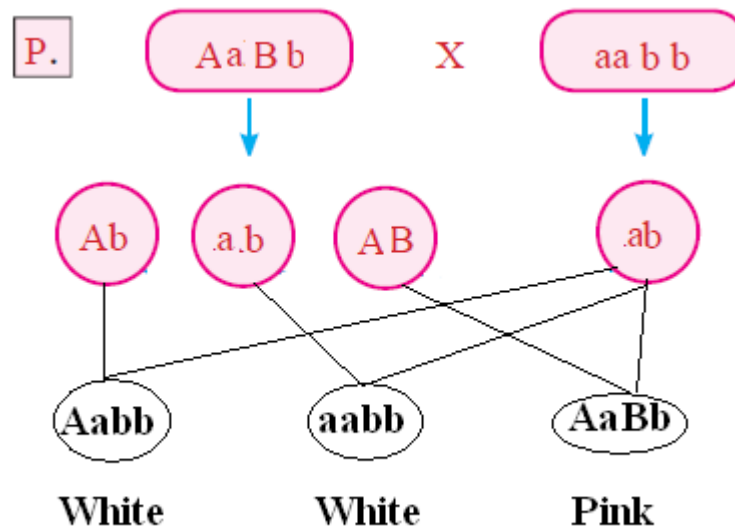


Example (2)

Determine the phenotypes and genotypes of the colour of flowers produced from the copulation ($AaBb \times aabb$)



Solution



Lethal genes

Lethal genes: They are genes which cause the death of the living organisms if they are present in homozygous (pure) state.

→ Lethal genes stop biological processes inside living organisms at different ages.

Kinds of lethal genes

1- Dominant lethal genes: (Ex. Yellow colour gene in mice – Bulldog race in cows)

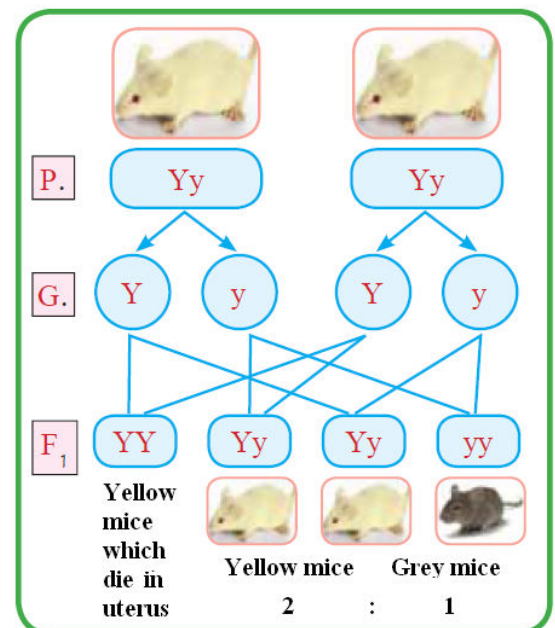
2- Recessive lethal genes: (Ex. The absence of chlorophyll in corn – infantile dementia in human)

Inheritance of colour trait in mice

→ When two hybrid yellow mice copulate, the ratio of product generation is 1:2.

→ Pure yellow mice die because they carry pure lethal dominant pair of gene (YY) which causes the death of mice in uterus.

→ These results contradicts with Mendel's first law of the segregation of factors because when two hybrid yellow mice copulate, they produce yellow and grey mice at ratio 3:1 according to Mendel's first law, while they produced yellow and grey mice at ratio 2:1



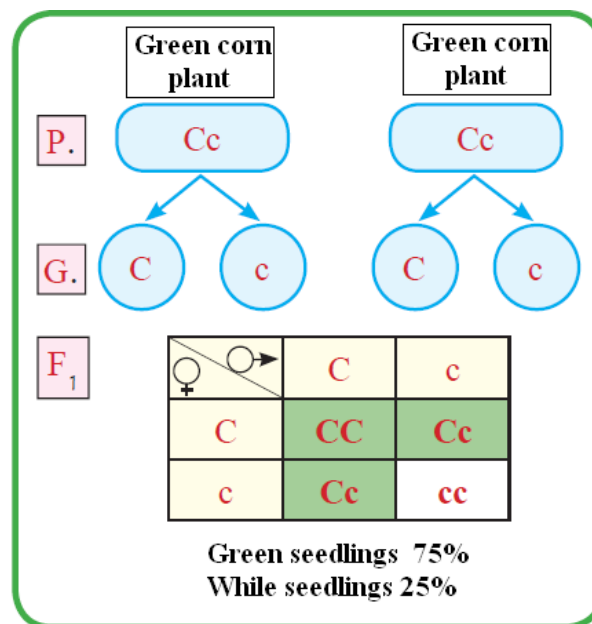
→ The ratio of dead yellow mice is 25% of the product generation

Inheritance of chlorophyll absence trait in corn plant

→ When some corn plants self-pollinate, they produce white seedlings which don't have chlorophyll. These seedlings grow for a short time, then they wither and die. This happens because of a pure recessive lethal gene (cc)

→ When two recessive lethal genes aggregate together in some individuals, chlorophyll will not be formed in them. Chlorophyll gives the plant its green colour and it is responsible for absorbing light rays to carry out photosynthesis process.

→ Plants carrying (cc) pair of genes are white and not able to perform photosynthesis process which causes their death.



The effect of environmental conditions on some genes work

→ The work of some genes is affected by the factors surrounding living organisms (**Ex.** Air pollutants – lack of oxygen – radiation) and environmental factors (**Ex.** Light – temperature).

→ The study of factors affecting genes help us avoid the risks resulted from them.

The effect of absence of light on chlorophyll trait in green plants

→ The gene responsible for chlorophyll formation in green plants needs light factor, so that the effect of gene appears.

→ Green plant cannot form chlorophyll if the gene responsible for it is absent, even if it was put in light

Definitions of lesson (1)

Lack of dominance: A form of inheritance in which no genes dominate over the other one, but they interact forming new trait

Antigens: They are chemical substances which exist on the surfaces of red blood cells, they play an important role in blood transfusion process.

Antibody: They are antibodies of antigens which exist in blood plasma, they play an importance role in blood transfusion process

Rhesus factor: A kind of antigens which exists on the surfaces of red blood cells of most humans, its inheritance is controlled by three pairs of genes which are carried on one chromosome pair.

Complementary genes: Genes which interact with each other causing the appearance of a hereditary trait.

Lethal genes: Genes which obstruct growth and cause death at different ages when they exist in pure (homozygous) form

Give reasons for

1- When two individuals different in one pair of hereditary traits copulate, the second generation ratio is 1:2:1 not 1:3

Because the genes of those different traits do not dominate over each other. So, they interact with each other forming new trait, which appears in 2nd generation with the two opposite traits at ratio 1:2:1 (not 1:3 – as Mendel laws state – because of the lack of dominance)

2- The importance of blood groups

Because they :-

- Solve problems of the determination of paternity (parents of children) and pedigree of children (blood groups denies pedigree but don't prove it)
- Determine blood transfusion processes between individuals.
- Are used in the study of human races classification and evolution

3- Blood group (O) is a universal donor, while blood group (AB) is a universal recipient

Blood group (O) is a universal donor because it has both antigen-a and antigen-b and doesn't have any antibodies, which makes it capable of giving blood to all groups. While blood group (AB) is a universal recipient because it has both anti-a and anti-b and doesn't contain any antigens, which makes it capable of receiving blood from all types.

4- Giving blood of inconvenient group to a recipient person is very dangerous.
Because giving blood to a person of a blood group unsuitable for his blood causes the break of red blood cells, which cause sickness, chest pain, irregular heartbeat, blueness, headache, and even death!!

5- Blood should be examined before transfusion process

To make sure it is convenient for the blood of recipient person and doesn't contain any disease-causing organisms (Ex. Viruses)

6-The importance of determination of rhesus factor in blood

Because it is very important to determine it before blood transfusion process and marriage; in order to prevent the formation of antibodies of Rh factor antigens, which breaks red blood cells.

7- Woman who was pregnant with a baby of different rhesus factor should take vaccine within 72 hours after every delivery

To break up the amount of blood mother had taken from her first fetus – which contains Rh+ - before her immune system forms Rh antibodies. Which protects her second fetus.

8- Inner cabbage leaves are not green-coloured

Because the gene responsible for chlorophyll formation in green plants (which give them its green colour) needs light; so that its effect will appear. But we find that inner cabbage leaves are not exposed to light.

What happens when

1- Transfusing blood from a man of group (AB) to another one of group (A)

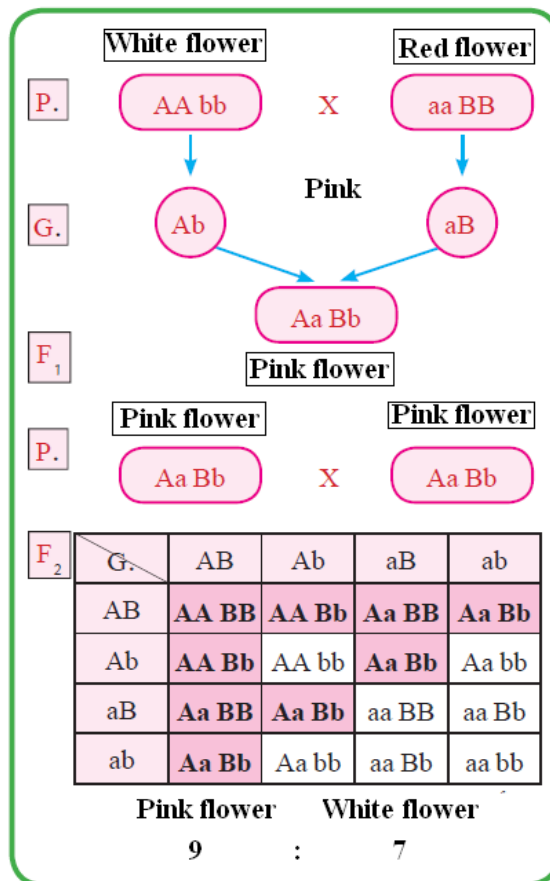
This will break red blood cells of the recipient person because his blood produces anti-b for antigens-B of blood group (AB), which causes shivering in body, chest pain, blueness, irregular heartbeat, headache, low blood pressure

2- (Rh-) woman married (Rh+) man (with respect to the first and second babies)

When the woman becomes pregnant with the first baby (which is Rh+), a part of his blood transfers from him to his mother, which stimulates her immune system to produce antibodies of Rh factor antigens. If mother wasn't given vaccine after delivery of the first baby, and became pregnant again with another baby, Rh+ blood transfers from mother to her second baby through placenta, which breaks up his red blood cells and causes him acute anemia and even death.

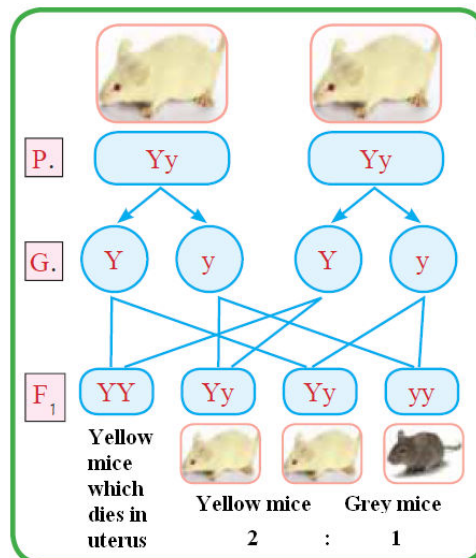
3- Two sweet pea plants with white flowers whose genotypes are (aaBB) and (AAbb) copulate (first and second generations)

100% pink flowers are produced in the first generation, while both pink and white flower appear in the second generation at ratio 9:7



4- Breeding two yellow mice (Yy)

Hybrid yellow and black mice are produced at ratio 2:1 respectively, pure yellow mice (YY) - which represent 25% of the generation – die in uterus before being born.



5- Planting corn plant seedlings in a dark place

Seedlings lose their green colour due to the lack of chlorophyll, as the gene responsible for chlorophyll formation is activated only by light (which is absent)

Questions

1- Choose the correct answer

1- in lack of dominance case, the ratio of 2nd generation resulted from the copulation of two individuals different in one pair of opposite traits is

A- 1:3 B- 1:2:1 C- 7:9 D- 1:2

2- When a man of blood group (AB) marries a woman of blood group (O), the ratio of children which have blood group (O) is

A- 0% B- 50% C- 25% D- 75%

3- Blood group which has both types of antigens is.....

A- A B- O C- AB D- B

4- Blood group which has both types of antibodies is.....

A- A B- O C- AB D- B

5- Blood group which is known as "Universal recipient" is

A- A B- O C- AB D- B

6- Blood group which is know as "Universal donor" is.....

A- A B- O C- AB D- B

7- Trait of flower colour of sweet pea plant is an example on

A- Lack of dominance B- Alleles multiplicity C- Complementary genes
D- Lethal genes

8- The inheritance yellow mice colour is an example on

A- Lack of dominance B- Alleles multiplicity C- Complementary genes
D- Lethal genes

9- gene is an example on recessive lethal genes

A- Yellow colour of mice B- Infantile dementia C- Turner's syndrome
D- Bulldog race in cow

10- is an example on dominant lethal genes

A- Yellow colour of mice B- Infantile dementia C- Turner's syndrome
D- Bulldog race in cow

2- Write the scientific term

1- A form of inheritance in which no genes dominate over the opposite one, but they interact forming new trait

2- chemical substances which exist on the surfaces of red blood cells, they play an important role in blood transfusion process.

3- A kind of antigens whose inheritance is controlled by three pairs of genes which are carried on one chromosome pair.

4- Genes which interact with each other causing the appearance of a hereditary trait.

5- Genes which obstruct growth and cause death at different ages when they exist in pure (homozygous) form

3- Write short notes about:-

1- Dangers of blood transfusion

2- Rhesus factor

3- Lethal genes

4- Complementary genes

4- Compare between

1- Blood types (A) and (B)

2- Lethal and complementary genes

5- Rationalize the following cases on a genetic basis

1- A man of blood group (A) married a woman of blood group (B) and bore a child of blood group (O)

2- A woman whose blood group is (AB) has a son of the same blood group, what are the probable genotypes of the father?

3- Breeding four o'clock plant with red flowers with another one of pink flowers.

6- The following table illustrates the generation resulted from the breeding of two sweet pea plants, then answer the following questions

♀ \ ♂	AB	--	aB	ab
--	(1) AABb	(2) AaBb		
--	(3) AAbb	(4) Aabb		

1- What are the genotypes of (1), (2), (3), (4)



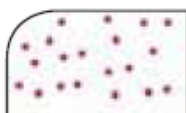


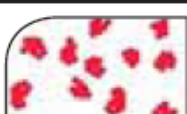
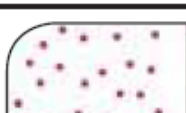

2- Find the genotypes of the parents

3- What is the percentage of white flowers in this generation?

4- What is the colour of flowers produced from the breeding of plant (4) with (3)

7- If your blood group is (A) and you need blood transfusion, which blood groups are suitable for you? Why?

8- Answer the following question

Group	anti-a	anti-b
.....		
.....		
.....		
.....		

- 1- Complete the previous table mentioning blood groups
- 2- Which blood group has both types of antigens?
- 3- Which blood group has both types of antibodies?

Answers

1- Choose the correct answer

- 1- 1:2:1
- 2- 0%
- 3- AB
- 4- O
- 5- AB
- 6- O
- 7- Complementary genes
- 8- Lethal genes
- 9- Infantile dementia
- 10- Yellow colour of mice

2- Write the scientific term

- 1- Lack of dominance
- 2- Antigens
- 3- Rhesus factor
- 4- Complementary genes
- 5- Lethal genes

3- Write short notes about:-

1- Giving blood to a person of an inconvenient group causes headache, shortness of breath, chest pain, irregular heartbeat, blueness, shivering in body and usually ends with death. Transfusing polluted blood to a person may cause viral infection (Ex. AIDS – Hepatitis B)

2- Rhesus factor is a kind of antigens which exist on the surfaces of red blood cells of 85% of humans, its inheritance is controlled by 3 pairs of genes which exist on one chromosome pair.

3- Lethal genes are genes which obstruct growth and cause death to living organisms if they are present in pure (homozygous) form. There are recessive lethal genes (such as the genes causing the absence of chlorophyll in corn plants and infantile dementia in humans) and dominant lethal genes (such as the genes of yellow colour of mice and bulldog race in cows)

4- Complementary genes are genes which interact together forming a certain trait. The appearance of this trait is controlled by two pair of genes, there must be at least one dominant gene in each pair so that the dominant trait appears. Otherwise, recessive trait will appear. The flower colour of sweet pea plant is an example of complementary genes

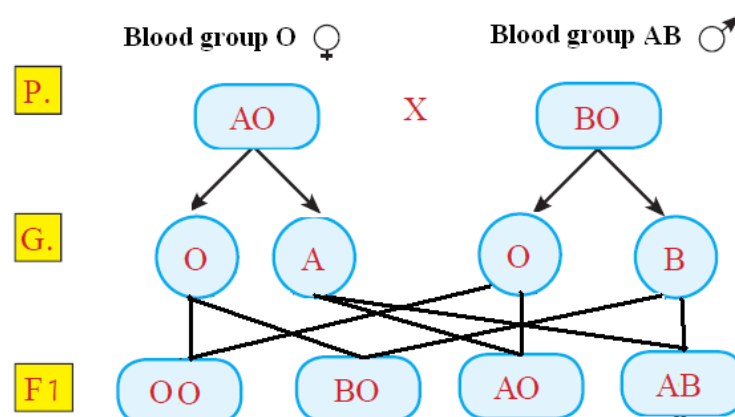
4- Compare between

P.O.C	Blood type (A)	Blood type (B)
Genotype	AA – AO	BB – BO
Antibody	Anti-b	Anti-a
Antigen	Antigen-a	Antigen-b
Receives blood from	Blood types (A) and (O)	Blood types (B) and (O)

Lethal genes	Complementary genes
- They are genes which obstruct growth and cause death to living organisms if they are present in a pure form - Ex. Infantile dementia gene in humans	- They are genes which interact together forming hereditary trait - Ex. Flower colour trait of sweet pea

5- Rationalize the following cases

Case (1)



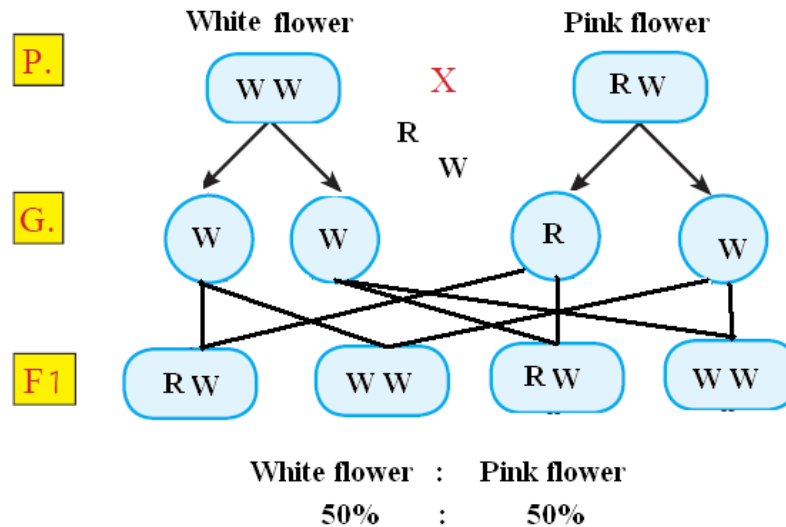
Case (2)

Genes forming blood type (AB) are (A) and (B)

Thus, father should have at least one of those genes in his blood type

Probable genotypes of father are (AO) – (AA) – (AB) – (BO) – (BB)

Case (3)



6- The following table illustrates the generation resulted from the breeding of two sweet pea plants, then answer the following questions

♀ \ ♂	AB	Ab	aB	ab
AB	(1)	AABb	(2)	AaBb
Ab	(3)	AAbb	(4)	Aabb

- 1- (1) AABB
- (2) AaBB
- (3) AABb
- (4) AaBb

2- Genotype of 1st parent: AaBb
Genotype of 2nd parent: AABb

3- 25%

4- 75% Pink flowers
25% white flowers

P.

Pink flower

Pink flower

Aa Bb

X

AA Bb

F₁

G. AB	AB	Ab	aB	ab
AB	AA BB	AA Bb	Aa BB	Aa Bb
Ab	AA Bb	AA bb	Aa Bb	Aa bb

Pink flower
6

:

White flower
2

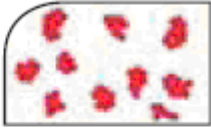



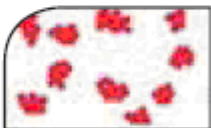
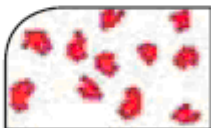


3

:

1

7- Blood of groups (A) and (O) will be suitable because group (A) has antigen-a and anti-b like my own blood group, and (O) group has no antigens and both a-anti and b-anti

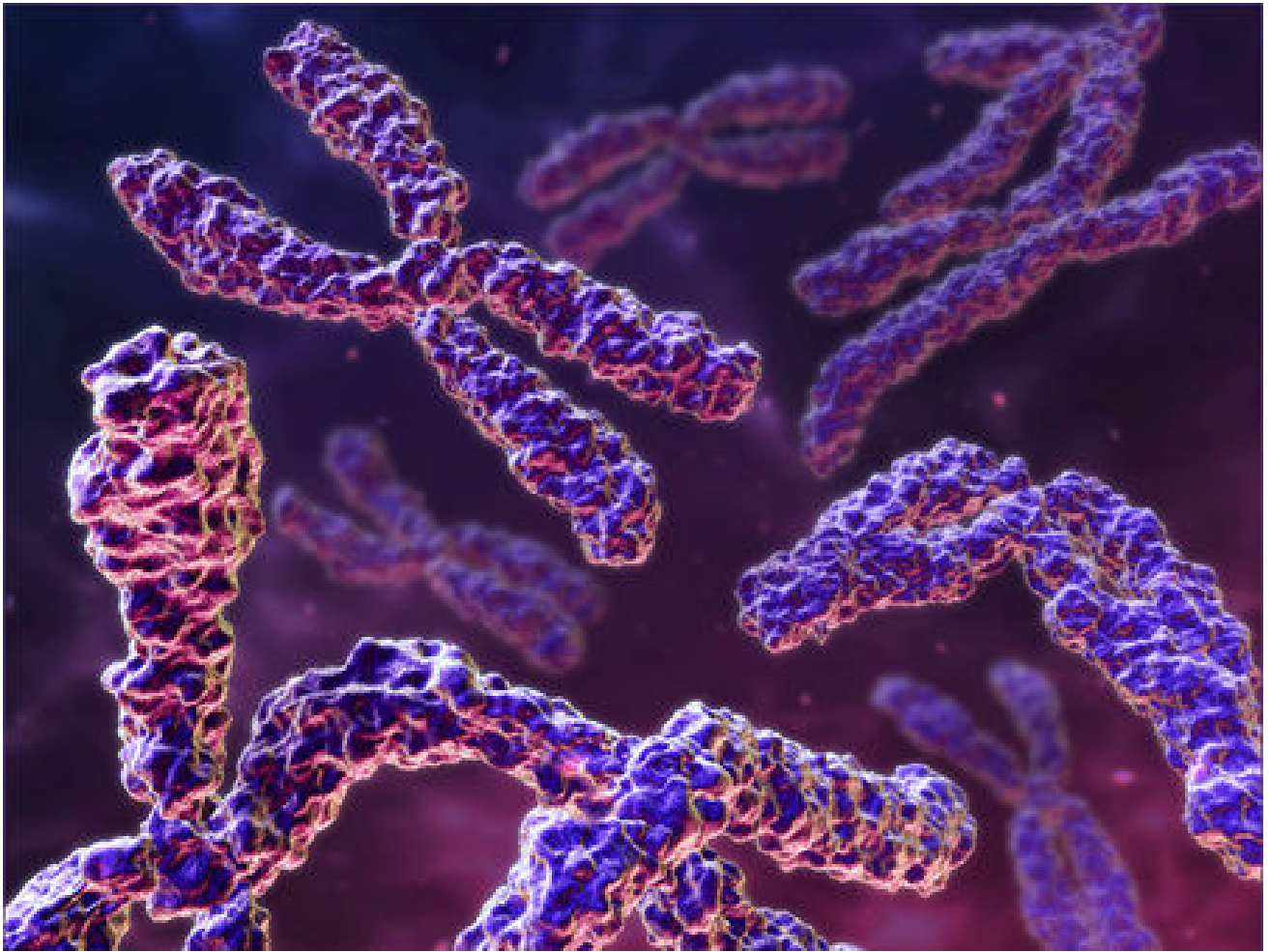
8-

Group	anti-a	anti-b
B		
A		
O		
AB		

2- (AB) group

3- (O) group

Lesson (3) Genetic inheritance and diseases



→ In the past, it was thought that woman controls the sex of her fetus, but in the middle of 20th century, when scientists discovered sex chromosomes, they discovered that man controls the sex of the fetus (not woman)

Sex determination in human

Human body has 23 pairs of chromosomes, they are divided into:-

1- Somatic chromosomes: They are 22 chromosomes pairs which are similar in both sexes (male and female)

2- Sex chromosomes: 1 chromosome pair, which determines the sex of human.

- Female cell: it has 22 pairs of somatic chromosomes, and a homologous pair of sex chromosomes (XX + 44)

- Male cell: It has 22 pairs of somatic chromosomes and a non-homologous pair of sex chromosomes (XY + 44)

→ Chromosomes (X) and (Y) are different in shape and size

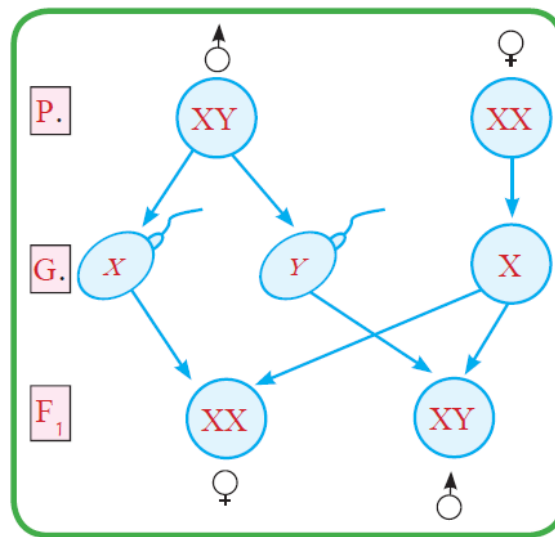


Fig. (5) Probabilities of sex determination of fetus

→ Gametes are formed from the meiotic cell division of gonads (testes in male and ovaries in female). So, gametes have half the number of chromosomes of somatic cells (Haploid number n)

→ Male produces two kinds of sperms with equal ratios – a kind of sperms carrying chromosomes (Y) and another one carrying chromosomes (X).

→ Female produces one kind of ova which carry chromosome (X)

→ If an ovum (X+22) was fertilized by sperm (X+22), a female fetus is formed (XX + 44)

→ If an ovum (X+22) was fertilized by sperm (Y+22), a male fetus is formed (XY+44)

Therefore, sperms determine the sex of fetus, not ovum

→ Genes carried on chromosomes (X) and (Y) are responsible for sex determination.

→ 6 weeks after conception (pregnancy), the fetus carrying (Y) chromosome begins secreting hormones which stimulate the undifferentiated tissues of gonads to form the tests and male sex organs.

→ 12 weeks after conception (pregnancy), the fetus which doesn't carry (Y) chromosome begins forming the two ovaries, and then female sex organs differentiate.

Abnormal chromosomal cases in human

Klinefelter's syndrome

→ This syndrome (case) was discovered by **Dr. Henry Klinefelter** in 1942.

Causes of Klinefelter's syndrome

→ When an abnormal ovum ($XX + 22$) – *Instead of ($X+22$)* – is fertilized by a sperm ($Y+22$), forming a fetus ($XXY + 44$) *instead of ($XY+44$)*. The extra (X) chromosome causes disorder in sex hormones.

→ This syndrome appears in males only

Symptoms

- 1- Infertile male due to the absence of the cells which produce sperms.
- 2- Mental retardation
- 3- The appearance of feminine characteristics (Ex. Enlargement of breasts)
- 4- Tall stature
- 5- Growth of limbs more than average rate

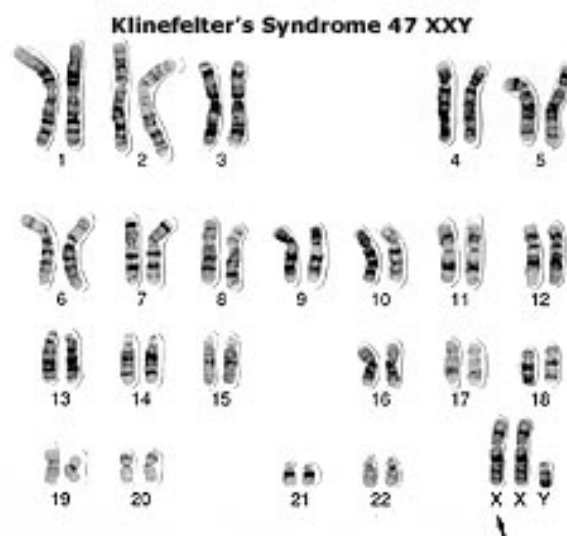


Fig. (6) Karyotype of Klinefelter's syndrome

Turner's syndrome

Causes of Turner's syndrome

→ When an abnormal ovum ($O+22$) – *Ovum without X chromosome* – is fertilized by a sperm ($X+22$), forming a fetus ($XO+44$) *fetus with only one X chromosome (instead of two)*

→ This syndrome appears in females only

Symptoms

- 1- Short stature
- 2- Woman doesn't hit puberty due to the lack of hormones.
- 3- Slow mental development
- 4- congenital disorder of heart and kidneys

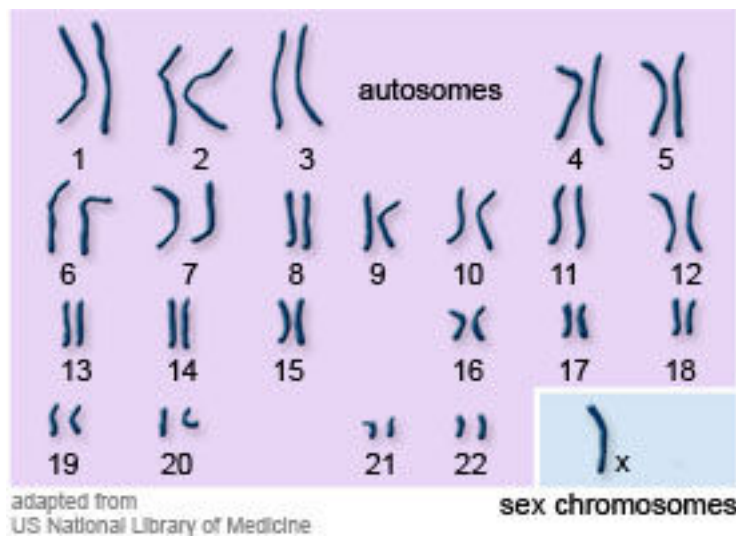


Fig. (7) Karyotype of Turner's syndrome

Down syndrome (Mongolism)

→ Mongolism was discovered by British doctor Down in 1866

Causes of down syndrome

→ caused by the fertilization of a gamete (sperm of ovum) gamete carrying a complete number of chromosomes in pair 21, which forms a fetus carrying 3 chromosomes in pair (21) *instead of 2 chromosomes*.

→ Baby with down syndrome may be a male ($XY+45$) or female ($XX+45$)

Symptoms of down syndrome

- 1- Delayed growth
- 2- Short stature
- 3- Oval face
- 4- Flat head back
- 5- Short fingers and toes

- 6- Narrow eyes
- 7- Small ears
- 8- Mental retardation

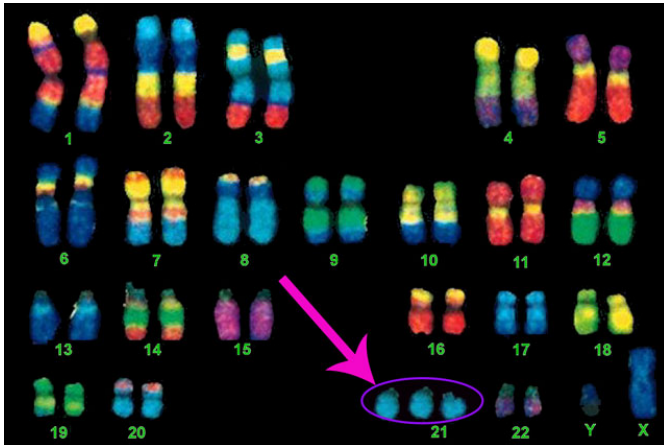


Fig. (7) Karyotype of down syndrome



(8) A girl with down syndrome

Sex-linked traits

Sex-linked traits: They are traits whose genes are carried on sex chromosomes, but their appearance is not affected by sex hormones

→ Scientist Thomas Morgan was the first to discover sex-linked traits while studying eye colour trait in *Drosophila* insect. He crossed white-eyed male RR XX *Drosophila* insects with red-eyed female r Xy *Drosophila* insects.

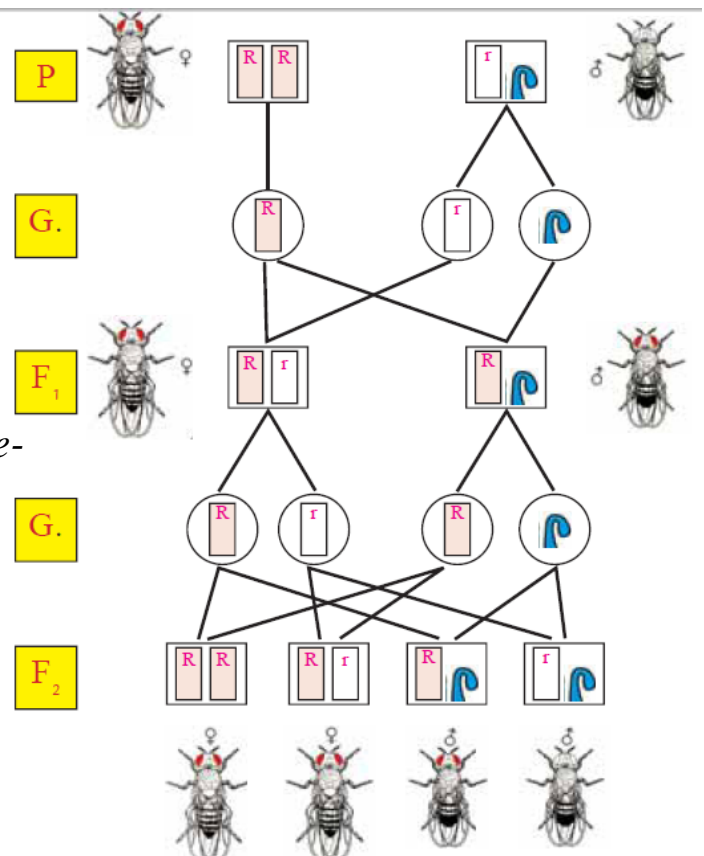
→ 100% of the individuals of 1st generation are red-eyed, which means that red eyes trait is dominant

→ Red-eyed and white-eyed insects were formed in 2nd generation at ratio 3:1

→ This trait is not a Mendelian one
Because Morgan discovered that all white-eyed insects are males!!!!

→ Morgan stated that these genes are carried on sex chromosome (X), while there are few genes on chromosome (Y)

Eye colour of *Drosophila* insect is an Example on sex-linked traits



Sex-linked traits in human

Chromosome (X) in human carries many somatic traits (Ex. Hemophilia – colour blindness – short sight – Muscle atrophy). These traits are inherited from the father to his daughters only because he gives them chromosome (X)

Colour blindness

- Colour blindness is caused by a recessive gene on sex chromosome (X).
- This gene causes the inability to differentiate between colours, especially **green** and **red**

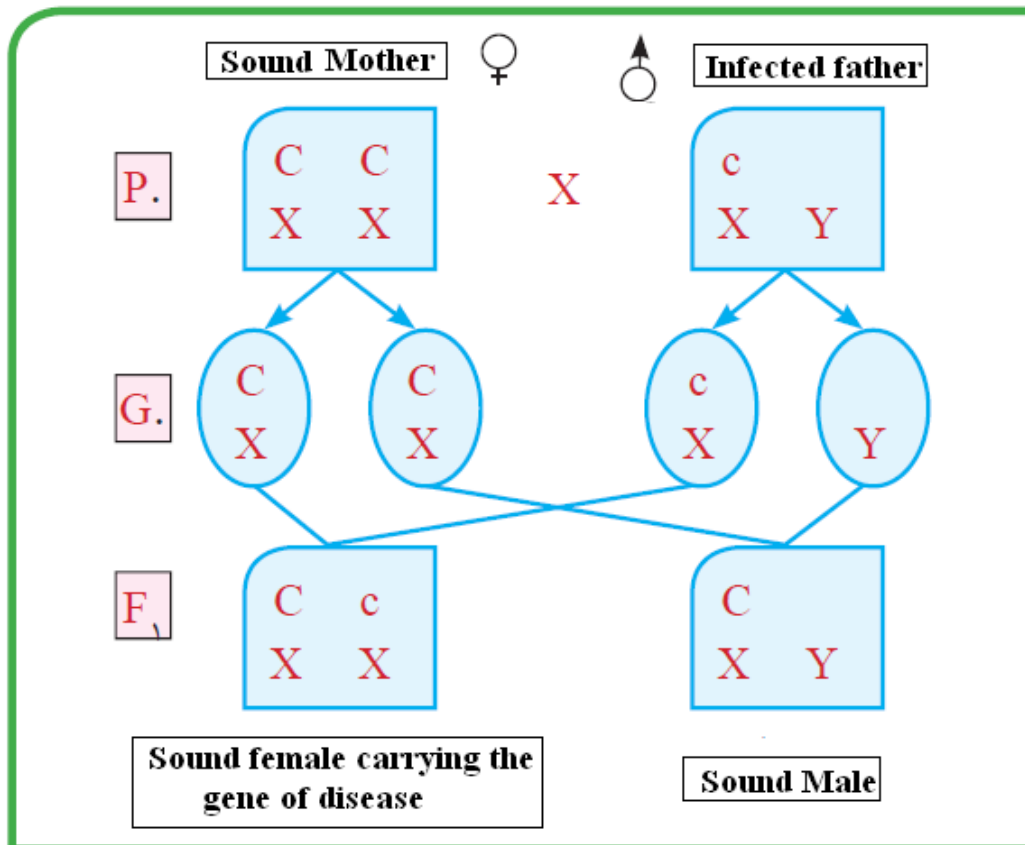


Fig. (9) Inheritance of colour blindness in human

In males, colour blindness trait is represented by only one gene because chromosome (Y) doesn't carry this trait, while it is represented by a pair of genes in females because they have a pair of sex chromosome (XX)

- A male doesn't give this trait to his sons, because they inherit from him chromosome (Y) not chromosome (X) (which carries colour blindness trait)
- Sons and daughters can inherit this trait from mother because they inherit chromosome (X) from her (which carries colour blindness trait)
- Male can give this trait to his grandsons through his daughters.

Hemophilia

Hemophilia: Genetic disease which causes the inability of body to control blood clotting (coagulation) process – the process which stops bleeding

→ Hemophilia is caused by a recessive gene carried on chromosome (X), this gene disables the body to control blood clotting process because some substances which are essential for blood clotting process are not formed

→ Hemophilia may cause death, especially in childhood stage

Sex-influenced traits

Sex-influenced traits: They are traits whose genes are carried on somatic chromosomes, and their appearance is affected by sex hormones

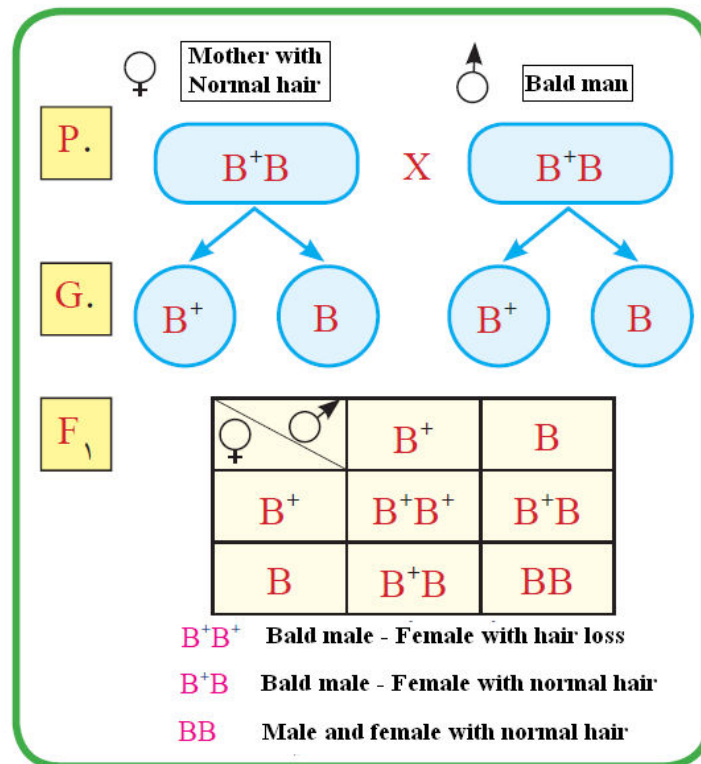
→ Sex-influenced traits are affected by male and female sex hormones

Examples:-

- 1- Horns trait in cattle
- 2- Baldness trait in human
- 3- Shortness of index finger trait in human

Baldness

The following figure describes the inheritance of hair loss trait in human



→ Baldness trait appears due to the existence of a dominant gene responsible for hair loss, this gene is affected by male sex hormone only.

→ The appearance of baldness trait is different in males and females.

→ baldness appears in males in cases of pure gene ($B+B+$) and hybrid gene ($B+B$) due to the influence of male sex hormone on them

→ Hair loss trait in females appears only in case of pure gene ($B+B+$)

→ People with genetic structure (BB) have normal hair



Fig. (10) Hereditary baldness in men



Fig.(11) hair loss in women

Sex-limited traits

Sex-limited traits: They are traits which appears in one of the two sexes only due to the difference in sex hormones

Sex-limited genes are responsible for the appearance of certain traits in each sex.

Examples:-

→ Milk production trait is limited on females only because they have sex hormones which stimulate the gene of this trait

→ Secondary sex characteristics in humans (Ex. The appearance of beards in men)

→ The ability of birds to lay eggs.

Methods of study in human genetics

A- Pedigree (family tree)

Scientists find it hard to study the inherited traits and their transfer to human due to:-

- The long time period between one generation and another.

- The small number of individuals resulted from every marriage

So, scientists study some hereditary traits in human by studying the pedigree (family tree) of some families

Pedigree: Hereditary data represented in the form of chart diagram which explains how a certain trait is inherited, and used in tracking different hereditary traits

Importance of pedigree

1- It explains how a certain trait is inherited in a certain family

2- It is used to trace different hereditary traits (especially those linked to genetic diseases and disorders)

3- It is used for prediction of the probability of appearance of these traits in coming generations.

The following chart describes pedigree of a family

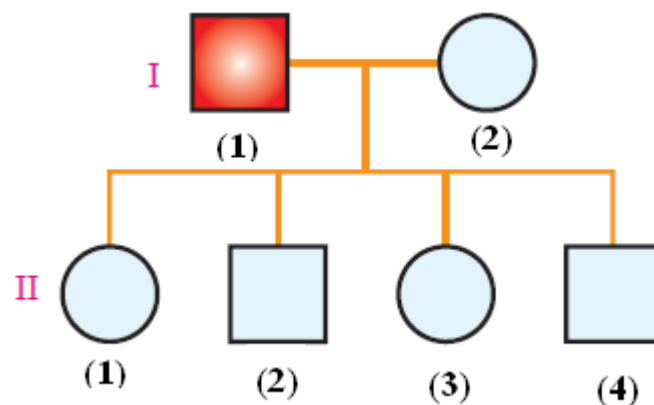


Fig. (12) Pedigree chart

- Male individuals are denoted by squares

- Female individuals are denoted by circles

- Mating (marriage) is symbolized by a line joining between the circle and square

- Offspring is symbolized by a vertical line extending from that of marriage

- Every generation is given a Roman number (I – II – III – V...etc)

- Every individual is given a number, in order to facilitate finding it

- Shaped which are studies are coloured (in the previous chart, father (1) of generation (I) is the individual being studied)

The study of genetic cases in human

1- Albinism (also called Albino or Sun enemy)

Albinism: Genetic disorder which causes the absence of melanin pigments from the cells of hair, eye lashes and skin.

→ Albinism is caused by the recessive gene (a)

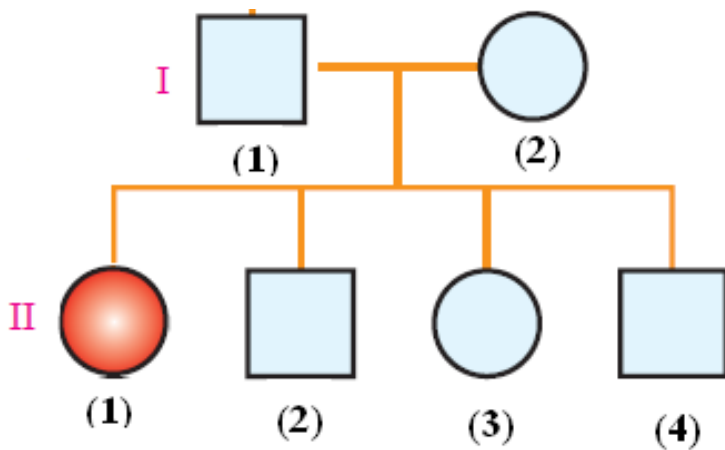


Fig. (13) Pedigree chart of albinism

Fig. (14) Child with Albinism

Probable genotypes of this family members are:-

Generation (I)

1- Aa 2- Aa

Generation (II)

1- aa 2- AA or Aa 3- AA or Aa 4- AA or Aa

2-Polydactyl

Polydactyl: Genetic disorder in which human has sixth fingers (instead of five), it is caused by a dominant gene



Fig. (14) Polydactyl genetic disorder

B- Gene maps (DNA analysis)

→ Scientists succeeded in creating a map of all human genes.

→ This map can help us determine the diseases with by which human may be infected in the future.

C- Amniotic fluid testing during pregnancy

Amniotic fluid: The fluid which surrounds the fetus in a pregnant female

→ Examining the chromosomes of fetus cells in amniotic fluid helps us determine the diseases caused by the increase or decrease of the no. of chromosomes (Ex. Down syndrome – Klinefelter's syndrome – Turner's syndrome), as we can get photos of these chromosomes and make Karyotype for the fetus.

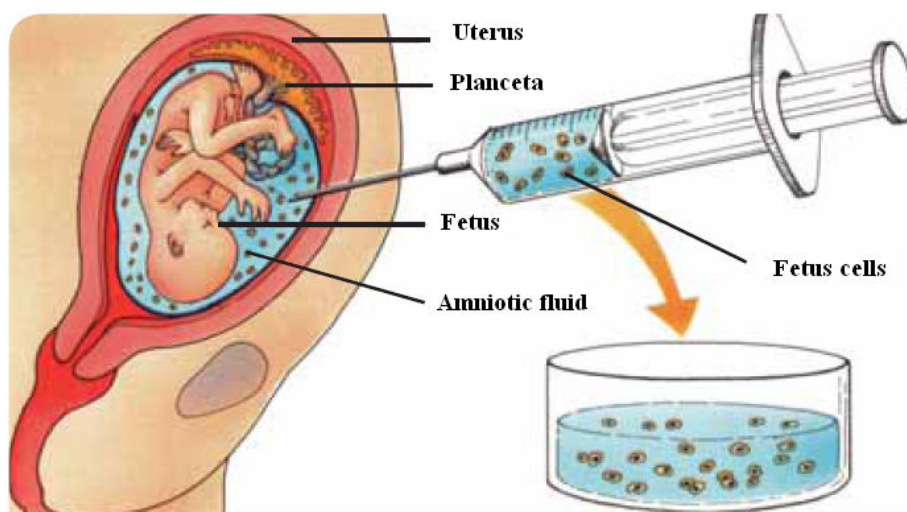


Fig. (15) Amniotic fluid testing

Medical tests before marriage

→ Medical test before marriage is a group of medical tests which are carried out by the couple before they marry

→ Medical tests make sure they are not infected by contagious diseases (such as hepatitis and Acquired immunity deficiency syndrome (AIDS)) or genetic diseases (Such as Thalassemia), which predicts the probability of the transfer of the disease to the other mate or children , and gives choices and advises to the couple in order to help them make a healthy family.

Factors of genetic diseases spread

1- Relatives marriage

2- Getting married without carrying out medical tests

The importance of medical tests

Medical tests help in:-

- *Having healthy children*
- *Limiting the spread of genetic diseases, congenital disorders and mental retardation*
- *Avoiding social, psychological and financial problems resulted from taking care of children with genetic diseases.*

Science, Technology and society

The DNA fingerprint (DNA typing)

→ In 1984, **Dr. Alec Jeffreys** (genetics scientist Leicester university in London) published a research in which he explained that the hereditary material may be repeated many times. After one year, he discovered that every person has unique sequences. These sequences cannot be the same in any two persons (except for identical twins). "Alec" patented his discovery in 1985 and called these sequences **The DNA fingerprint**

The DNA fingerprint: A method used to recognize a person by the comparison of his DNA sequences

The importance of DNA fingerprint

Field of medicine:-

- *Used in the study of genetic diseases*
- *Used in tissues transplantation process*

Field of forensics

- *It helps in recognizing deformed dead bodies and tracking lost children*
- *It helped courts begin investigations in crimes whose offenders were unknown.*
- *It acquitted hundreds of people who were accused of rape and murder crimes and convicted others*
- *It plays an important role in parentage cases*

Human genome

→ Human genome contains all genes which exist in the nucleus of somatic cell

→ There are from 60,000 to 80,000 genes in nucleus, these genes are carried on 23 pairs of chromosomes. These genes cause the appearance of all these numerous human traits.

→ In 1953, scientists Watson and Creek discovered that genes are carried on a double helix of DNA.

→ In 1980, the idea of genome emerged. In that time, the number of discovered human genes was only 450 genes, in middle 80's the number of discovered genes became 1500. Scientists aimed to draw a genome map by determining the locations of genes on chromosomes, which would help them determine genes causing genetic diseases

The importance of genome

Scientists aim to use genome in :-

- The manufacture of drugs without side effects
- The study of evolution of living organisms by comparing human genome to that of other organisms
- Improving offspring by determining the genes causing diseases in the fetus before its birth and improving them.

Definitions of lesson (1)

Klinefelter's syndrome: Genetic disorder caused by the increase of sex chromosome (X) in some males (XXY + 44)

Turner's syndrome: Genetic disorder caused by the decrease of chromosome (X) in some females (XO+44)

Down's syndrome: Genetic disorder caused by the existence of an additional chromosome in chromosome pair (21)

Sex-linked traits: They are traits whose genes are carried on sex chromosomes , but their appearance is not affected by sex hormones.

Sex-influenced traits: They are traits whose genes are carried on somatic chromosomes, and their appearance is affected by sex hormones.

Hemophilia: Genetic disease which causes the inability of body to control blood clotting process – the process which stops bleeding

Sex-limited traits: They are traits which appear in one of the two sexes only due to the difference in sex hormones

Albinism: Genetic disorder which causes the absence of melanin pigments from the cells of hair, eye lashes and skin

Pedigree: Diagram which represents hereditary data which explains how a certain trait is inherited, and used in tracing different hereditary traits

DNA fingerprint: A method used to recognize a person by the comparison of his DNA sequences

Give reasons for

1- A Sperm determines the sex of fetus not ovum

Because there are two kinds of sperms – a kind carrying (X) sex chromosome and another one carrying (Y) sex chromosome, while ova have only one kind (which carries X sex chromosome). When a sperm carrying (Y) chromosome fertilizes an ovum of (X) chromosome, a male fetus (XY) is formed, while when a sperm of (X) chromosome fertilizes an ovum, a female fetus (XX) is formed.

2- A male with Klinefelter's syndrome is infertile and has feminine traits

Because it has an additional (X) sex chromosome in his Karyotype, which causes the disorder of sex hormones, as there are female sex hormones on (X) chromosome

3- A female with Turner's syndrome cannot hit puberty

Due to the lack of female sex hormones responsible for puberty, as this female has only one (X) sex chromosome instead of two.

4- Klinefelter's syndrome affects males only

Because Klinefelter's syndrome is caused when an abnormal ovum having 2 (X) chromosome (XX+22) is fertilized by a sperm (Y+22), which forms a male zygote of Karyotype (XXY+44)

5- Turner's syndrome affects females only

Because Turner's syndrome is caused when an abnormal ovum with no X chromosomes (O+22) is fertilized by a sperm (X+22), which forms a female zygote of Karyotype (XX+44).

6- Eye colour of Drosophila insect is from sex-linked traits

Because eye colour trait of Drosophila insect exists on sex chromosomes, and not affected by sex hormones

7- Colour blindness is more common in males than females

Because colour blindness trait gene is carried on one (X) sex chromosome in males, while it has two genes carried on (XX) sex chromosomes in females. And as we know, a males carries only one (X) chromosome, while a woman carries two (X) chromosomes, so colour blindness is more common in men.

8- Males cannot inherit colour blindness from their fathers

Because they inherit sex chromosomes (Y) from father, not chromosome (X) on which colour blindness gene is carried.

9- Both females and males can inherit colour blindness from their mothers

Because both of them inherit chromosome (X) from mother – the chromosome on which colour blindness gene is carried

10- A man with genotype (B+B) is infected with baldness, while a female with the same genotype has normal hair

Because baldness is from sex-influenced traits, so its gene is only affected by male sex hormones

11- Scientists find it hard to study the inherited traits and how they transfer to human.

Due to:-

- The long time between a generation and another one
- The small number of individuals resulted from every marriage

12- Pedigree is from the most important methods in human genetics

Because:-

- 1- It explains how a certain trait is inherited in a certain family
- 2- It is used to trace different hereditary traits (especially those linked to genetic diseases and disorders)
- 3- It is used for prediction of the probability of appearance of these traits in coming generations

13- The importance of DNA analysis (gene map)

Because this map can help us determine the diseases with by which human may be infected in the future.

14- The spread of genetic diseases and disorders

Due to:-

- 1- Marriage of relatives
- 2- Getting married without carrying out medical tests

15- The importance of carrying out medical tests before marriage

Because medical tests help in:-

- Having healthy children
- Limiting the spread of genetic diseases, congenital disorders and mental retardation
- Avoiding social, psychological and financial problems resulted from taking care of children with genetic diseases

16- DNA fingerprint plays an important role in the field of medicine

Because:-

- It is used in the study of genetic diseases
- It is used in tissues transplantation process

17- Amniotic fluid testing is very important during pregnancy

Because it helps us determine the diseases caused by the increase or decrease of the no. of chromosomes (Ex. Down syndrome – Klinefelter's syndrome – Turner's syndrome), as we can get photos of these chromosomes and make Karyotype for the fetus.

18- The importance of DNA fingerprint in forensic science

Because:-

- It helps in recognizing deformed dead bodies and tracking lost children*
- It helped courts begin investigations in crimes whose offenders were unknown.*
- It acquitted hundreds of people who were accused of rape and murder crimes and convicted others*
- It plays an important role in parentage cases*

19- The importance of genome in human genetics

Because scientists aim to use genome in :-

- The manufacture of drugs without side effects*
- The study of evolution of living organisms by comparing human genome to that of other organisms*
- Improving offspring by determining the genes causing diseases in the fetus before its birth and improving them*

What happens when

1- A sperm (Y+22) fertilizes an ovum (X+22)

A male zygote (XY+44) is formed

2- A sperm (X+22) fertilizes an ovum of the same Karyotype

A female zygote (XX+44) is formed

3- A sperm (Y+22) fertilizes an abnormal ovum (XX+22)

A male fetus (XXY+44) suffering from Klinefelter's syndrome is formed, which makes him infertile and causes the appearance of some feminine traits, tall stature, growth of limbs more than average rate and mental retardation due to the disorder of sex hormones.

4- A sperm (X+22) fertilizes an abnormal ovum (O+22)

A female fetus (XO+22) suffering from Turner's syndrome is formed, which makes her unable to hit puberty due to the lack of hormones and causes short stature, slow mental development, and congenital disorders in heart and kidneys.

5- The fertilization of a gamete carrying a complete pair of chromosome in pair (21)

A male fetus (XY+45) or female fetus (XX+45) suffering from Down syndrome is formed (because of having 3 copies of chromosome 21), which causes mental retardation, short stature, oval face, flat head back, short fingers and toes, small ears and narrow eyes

Comparison

Point of comparison	Sex-linked traits	Sex-influenced traits	Sex- limited traits
Definition	<i>They are traits whose genes are carried on sex chromosomes , but their appearance is not affected by sex hormone</i>	<i>They are traits whose genes are carried on somatic chromosomes, and their appearance is affected by sex hormone</i>	<i>They are traits which appears in one of the two sexes only due to the difference in sex hormone</i>
Examples	<i>Eye colour of Drosophila</i>	<i>Baldness / Hemophilia</i>	<i>Milk production n females</i>

Point of comparison	Down syndrome	Klinefelter's syndrome	Turner's syndrome
Karyotype	<i>(XX + 45) or (XY+45)</i>	<i>(XXY + 44)</i>	<i>(XO+44)</i>
Causes	<i>The fertilization of a gamete carrying a complete pair of chromosome (21)</i>	<i>The fertilization of an abnormal ovum (XX+22) by a sperm (Y+22)</i>	<i>The fertilization of an abnormal ovum (O+22) by a sperm (X+22)</i>
Symptoms	<ul style="list-style-type: none"> - Mental retardation - Narrow eyes - Short stature - Short toes and fingers - Flat head back - Delayed growth - Oval face - Small ears 	<ul style="list-style-type: none"> - Infertile male - The appearance of feminine traits (growth of breast) - Tall stature - Mental retardation - Overgrowth of limbs 	<ul style="list-style-type: none"> - Female's inability to hit puberty - Congenital disorders in kidneys and heart - Short stature

Questions

1- Choose the correct answer

1- The Karyotype of male cell is

A- $XX + 44$ B- $XY + 44$ C- $XO + 44$ D- $XXY + 44$

2- The Karyotype of female cell is

A- $XX + 44$ B- $XY + 44$ C- $XO + 44$ D- $XXY + 44$

3- Karyotype of Klinefelter's syndrome is

A- $XXY + 44$ B- $XO + 44$ C- $YO + 45$ D- $XY + 45$

4- Karyotype of Turner's syndrome is

A- $XXY + 44$ B- $XO + 44$ C- $YO + 45$ D- $XY + 45$

5- Down syndrome is caused by the fertilization of an ovum ($X + 22$) with sperm

A- $X + 23$ B- $Y + 23$ C- $X + 22$ D- $Y + 22$

6- affects males only

A- Turner's syndrome B- Klinefelter's syndrome C- Down syndrome
D- Hepatitis

7- affects females only

A- Turner's syndrome B- Klinefelter's syndrome C- Down syndrome
D- Hepatitis

8- is also known as Mongolism

A- Turner's syndrome B- Klinefelter's syndrome C- Down syndrome
D- Hemophilia

9- The eye colour of *Drosophila* insect is an example on traits

A- Sex-linked B- Sex-influenced C- Sex-limited D- Mendilian

10- Colour blindness trait is an example on traits

A- Sex-linked B- Sex-influenced C- Sex-limited D- Mendilian

11- When a sound male and a female infected with colour blindness marry, the appearance of this case will be in

A- All males B- All females C- Half the males D- Half the females

12- Hemophilia is an example on traits

A- Sex-linked B- Sex-influenced C- Sex-limited D- Mendilian

13- Growth of beards in males is an example on Traits

A- Sex-linked B- Sex-influenced C- Sex-limited D- Mendilian

14- Genetic disorder which causes the absence of melanin pigments in human body is called

A- Albinism B- Hemophilia C- Polydactyl D- Baldness

15- DNA fingerprint was discovered by scientist

A- Gregory Mendel B- Watson and Creek C- T. Morgan D- Alec Jeffreys

2- Write the scientific term

1- Genetic disorder caused by the increase of sex chromosome (X) in some males (XXY + 44)

2- Genetic disorder caused by the decrease of chromosome (X) in some females (XO+44)

3- Genetic disorder caused by the existence of an additional chromosome in chromosome pair (21)

4- They are traits whose genes are carried on sex chromosomes , but their appearance is not affected by sex hormones.

5- They are traits whose genes are carried on somatic chromosomes, and their appearance is affected by sex hormones.

6- Genetic disease which causes the inability of body to control blood clotting process – the process which stops bleeding

7- They are traits which appear in one of the two sexes only due to the difference in sex hormones

8- Genetic disorder which causes the absence of melanin pigments from the cells of hair, eye lashes and skin

9- Diagram which represents hereditary data which explains how a certain trait is inherited, and used in tracing different hereditary traits

10- A method used to recognize a person by the comparison of his DNA sequences

3- Write short notes about

1- Sex-linked traits

2- Sex-influenced traits

3- Sex- limited traits

4- Turner's syndrome

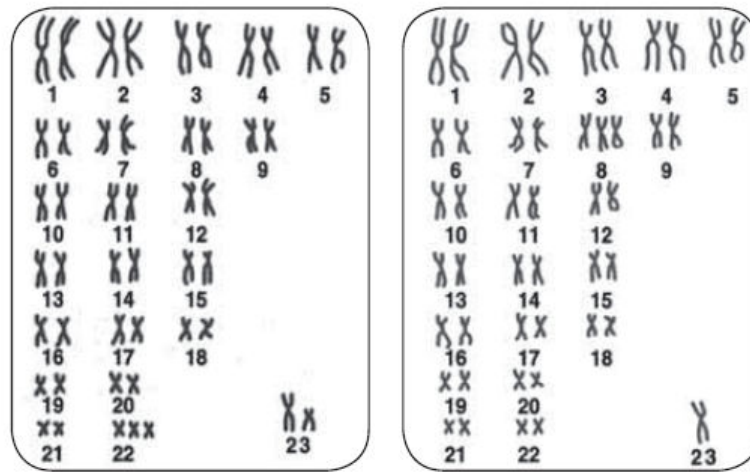
5- Klinefelter's syndrome

6- Down syndrome

7- Genome

8- DNA fingerprint

4- Study the following figure and answer the questions

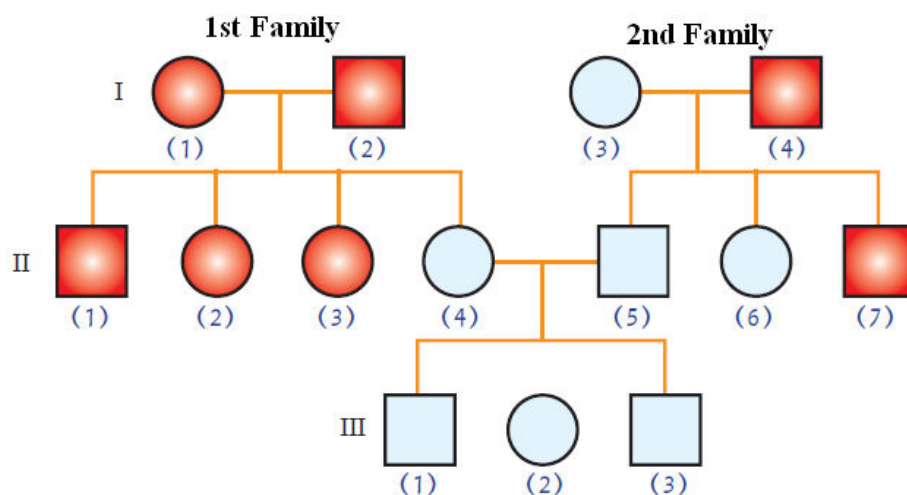


Karyotype (1)

Karyotype (2)

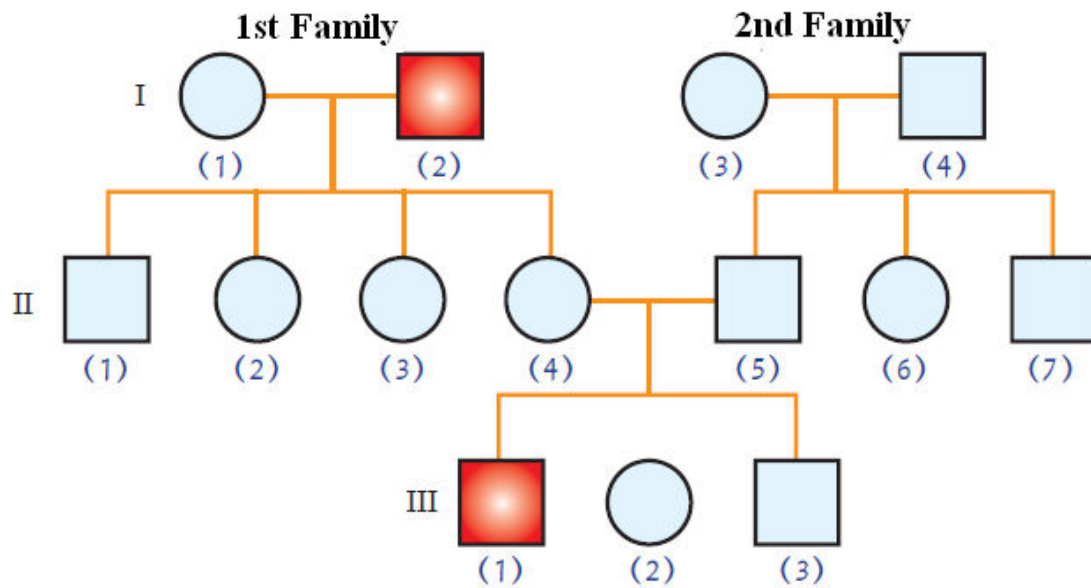
- 1- What is the number of chromosomes in karyotypes (1) and (2)?
- 2- What are the sexes of the individuals carrying karyotypes (1) and (2)?
- 3- What is the name, causes and symptoms of the abnormal condition in karyotype (1)?
- 4- What is the name, causes and symptoms of the abnormal condition in karyotype (2)?

5- The following pedigree chart describe the ability to roll tongue trait, answer the questions



- 1- Is this trait dominant or recessive? Why?
- 2- What are the genotypes of the following individuals
 - I (1)
 - I (3)
 - II (3)
 - II (5)
 - III (1)

6- The following pedigree charts describe the inheritance of Hemophilia trait, answer the following questions



1- Is this trait dominant or recessive?

2- Write the genotypes of the following individuals

I (1)

I (2)

II (1)

II (5)

III (1)

The Answers

1- Choose the correct answer

1- XY+44

2- XX + 44

3- XXY + 44

4- XO +44

5- Y + 23

6- Klinefelter's syndrome

13- Sex-limited

15- Alec Jeffreys

7- Turner's syndrome

8- Down syndrome

9- Sex-linked

10- Sex-linked

11- All males

12- Sex-linked

14- Albinism

2- Write the scientific term

- | | |
|-------------------------------|-----------------------|
| 1- Klinefelter's syndrome | 6- Hemophilia |
| 2- Turner's syndrome | 7- Sex-limited traits |
| 3- Down syndrome | 8- Albinism |
| 4- Sex-linked chromosomes | 9- Pedigree chart |
| 5- Sex-influenced chromosomes | 10- DNA fingerprint |

4- Study the following figure and answer the questions

1- Karyotype (1): 47 chromosomes – Karyotype (2): 45 Chromosomes

2- Karyotype (1): Male – Karyotype (2): Female

3- Name: Down syndrome

Cause: Fertilization of a gamete having a complete pair of chromosomes 21

Symptoms: Mental retardation – Delayed growth – Oval face – Narrow eyes – Short stature – Small ears – Flat head back – Short fingers and toes

4- Name: Turner's syndrome

Cause: Fertilization of an abnormal ovum ($XO+22$) by a sperm ($X+22$)

Symptoms: Short stature – Inability to hit puberty – Congenital disorders in heart and kidneys

5-

1- Rolling tongue trait is dominant because it appeared in all members of 1st generation in the first family at ratio 100%, and 2nd generation at ratio 75%

2-

I (1) $\rightarrow Bb$

I (3) $\rightarrow bb$

II (3) $\rightarrow BB$ or Bb

II (5) $\rightarrow bb$

III (1) $\rightarrow bb$

6-

1- Recessive

2-

I (1) $\rightarrow AA$

I (2) $\rightarrow aa$

II (4) $\rightarrow Aa$

II (5) $\rightarrow Aa$

III (1) $\rightarrow aa$

General test on chapter (3)

Answer four questions only

Question (1)

A- Choose the correct answer

1- The points of connection of internal chromatids in homologous chromosomes pairs is called

A- Chiasma B- Chromosome C- Centromere D- Centrosome

2- In gametes, chromosomes which didn't undergo crossing over are called

A- New chromosomes B- Building chromosomes C- Parental chromosomes
D- Chromatids

3- When a sound male and a female infected with colour blindness marry, the appearance of this case will be in

A- All males B- All females C- Half the males D- Half the females

4- Blood group which is known as "Universal donor" is.....

A- A B- O C- AB D- B

5- Trait of flower colour of sweet pea plant is an example on

A- Lack of dominance B- Alleles multiplicity C- Complementary genes
D- Lethal genes

B- Give reasons for

1- Turner's syndrome affects females only

2- The importance of blood groups

3- The importance of crossing over phenomenon

4- Colour blindness is more common in males than females

Question (2)

A- Write the scientific term

1- Genes which interact with each other causing the appearance of a hereditary trait.

2- A form of inheritance in which no genes dominate over the opposite one, but they interact forming new trait

3- chemical substances which exist on the surfaces of red blood cells, they play an important role in blood transfusion process.

4- Genetic disorder caused by the decrease of chromosome (X) in some females (XO+44)

5- Genetic disorder caused by the existence of an additional chromosome in chromosome pair (21)

B- What happens when

1- Breeding two yellow mice (Yy)

2- A sperm (Y+22) fertilizes an abnormal ovum (XX+22)

3- Two sweet pea plants with white flowers whose genotypes are (aaBB) and (AAbb) copulate (first and second generations)

4- Transfusing blood from a man of group (AB) to another one of group (A)

Question (3)

A- Match

(A)	(B)
1- Flower colour of sweet pea plant	A- Lack of dominance
2- Colour blindness in human	B- Lethal genes
3- Yellow colour of mice	C- Complementary genes
4- Flower colour of four o'clock plant	D- Sex-linked traits
5- Milk production in females	E- Sex-influenced traits
	F- Sex-limited traits

B- Write short notes about

1- Chromosomal theory

2- Rhesus factor

3- Pedigree

4- Sex-limited traits

Question (4)

A- Correct the underlined words

1- The genetic disorder caused by extra (X) sex chromosome in males is Down syndrome

2- DNA fingerprint was discovered by Thomas Morgan

3- Hemophilia is an example on sex-influenced traits

4- The appearance of chlorophyll is affected by the factor of temperature

5- The ratio of 2nd generation in case of complementary genes is 1:3:3:9

B- Compare between

1- Blood types (A) and (B)

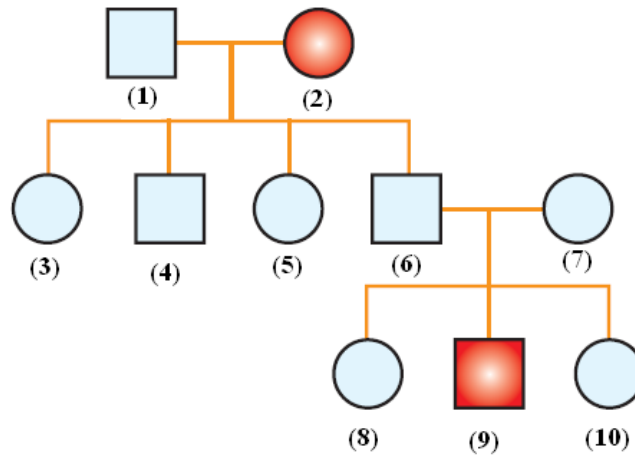
2- Lethal and complementary genes

3- Klinefelter's and Turner's syndrome

4- Antigens a and anti-a

Question (5)

A- The following figure describes the pedigree chart for the trait of freckles presence , answer the questions



1- Is this trait dominant or recessive? Why?

2- What are the probable genotypes of individuals (1), (2), (6), (7), (9)

Solution

Question (1)

A- Choose the correct answer

- 1- Chiasma
- 2- Parental chromosomes
- 3- All males
- 4- O
- 5- Complementary genes

B- Give reasons for

1- Because Turner's syndrome is caused when an abnormal ovum with no X chromosomes ($O+22$) is fertilized by a sperm ($X+22$), which forms a female zygote of Karyotype ($XX+44$).

2- Because they :-

- Solve problems of the determination of paternity (parents of children) and pedigree of children (blood groups denies pedigree but don't prove it)
- Determine blood transfusion processes between individuals.
- Are used in the study of human races classification and evolution

3- Because it causes the variation of hereditary traits of the members of same species, which helps them in the adaptation with environment conditions, and the development and continuation of their life.

4- Because colour blindness trait gene is carried on one (X) sex chromosome in males, while it has two genes carried on (XX) sex chromosomes in females. so colour blindness is more common in men because they should have only one recessive gene to be infected with colour blindness .

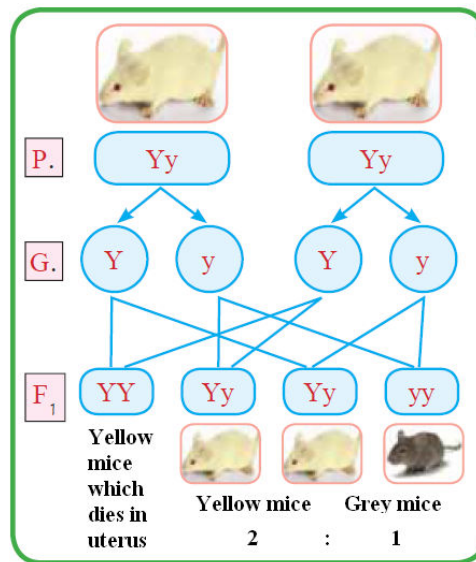
Question (2)

A- Write the scientific term

- 1- Complementary genes
- 2- Lack of dominance
- 3- Antigens
- 4- Turner's syndrome
- 5- Down syndrome

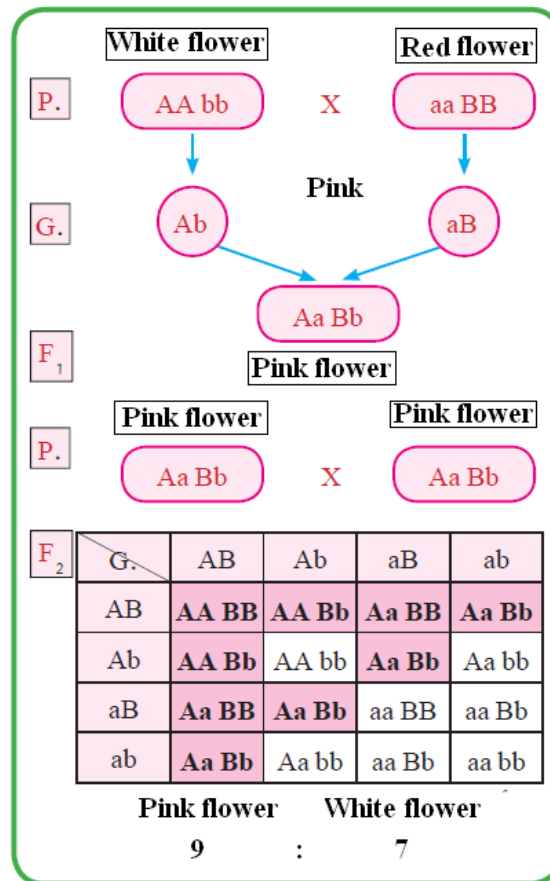
B- What happens when

1- Hybrid yellow and black mice are produced at ratio 2:1 respectively, pure yellow mice (YY) - which represent 25% of the generation – die in uterus before being born.



2- This causes Klinefelter's syndrome, which affects males and make them infertile.

3- 100% pink flowers are produced in the first generation, while both pink and white flower appear in the second generation at ratio 9:7



4- This will break red blood cells of the recipient person because his blood produces anti-b for antigens-B of blood group (AB), which causes shivering in body, chest pain, blueness, irregular heartbeat, headache, low blood pressure

Question (3)

A- Match

1- C 2- D 3-B 4-A 5-F

B- Write short notes about

1- Scientists Boveri and Sutton put chromosome theory in 1902, which states that:-

- 1- Chromosomes exist in somatic cells in the form of homologous pairs (2n)
- 2- Gametes contain half the no. of chromosomes in somatic cells as a result of meiotic cell division; where homologous pairs get separated from each other forming two identical groups
- 3- Each pair of chromosomes acts independently when transferring to gametes.
- 4- After fertilization process, the normal number of chromosomes (2n) comes back
- 5- Each chromosome carries hundreds of genes.

2- Rhesus factor is a kind of antigens which exist on the surfaces of red blood cells of 85% of humans, its inheritance is controlled by 3 pairs of genes which exist on one chromosome pair.

3- Hereditary data represented in the form of chart diagram which explains how a certain trait is inherited, and used in tracing different hereditary traits

4- They are traits which appear in only one of the two sexes due to the difference of hormones, such as the growth of beard trait in men and milk production trait in women.

Question (4)

A- Correct the underlined words

1- Klinefelter's syndrome

2- Dr. Alec Jeffreys

3- Milk production trait in women

4- Light

5- 7:9

B- Compare between

Blood group (A)	Blood group (B)
<ul style="list-style-type: none"> - It has antigens-a - It has antibodies (anti-b) - Its genotype is AA or AO - Receives blood from groups (A), (O) - Gives blood to groups (A) and (AB) 	<ul style="list-style-type: none"> - It has antigens-b - It has antibodies (anti-b) - Its genotype if BB or BO - Receives blood from groups (B), (O) - Gives blood to groups (B), (AB)

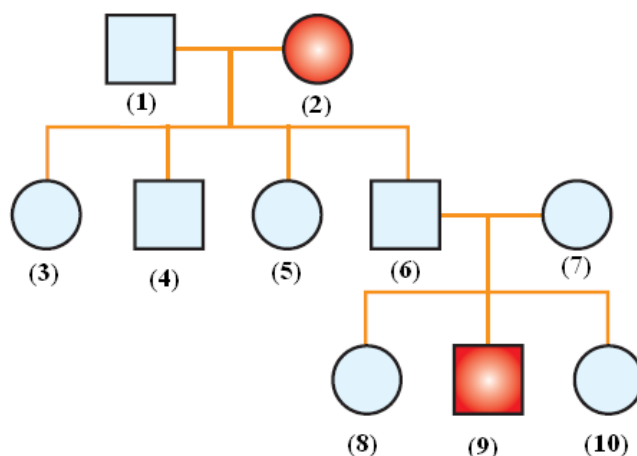
Lethal genes	Complementary genes
<ul style="list-style-type: none"> - They are genes which cause the death of living organisms if they are present in pure form because they stop its biological processes <p>Ex. Yellow colour of mice trait</p>	<ul style="list-style-type: none"> - They are genes which interact together forming new trait <p>Ex. Flower colour of sweet pea plant</p>

Klinefelter's syndrome	Turner's syndrome
<ul style="list-style-type: none"> - Its karyotype is (XXY+44) - Caused due to the fertilization of an abnormal ovum (XX+22) by a sperm (Y+22) - If affects males only - It causes infertility, tall stature, ..etc 	<ul style="list-style-type: none"> - Its karyotype is (XO+44) - Caused due to the fertilization of an abnormal ovum (O+22) by a sperm (X+22) - If affects Females only - It causes inability to attain puberty

<i>Antigens-a</i>	<i>Antibodies-a</i>
<i>They exist in blood groups (A) and (AB)</i>	<i>They exist in blood groups (B) and (O)</i>

Question (5)

A- The following figure describes the pedigree chart for the trait of freckles presence , answer the questions



1- This trait is recessive because it disappeared in all members of 1st generation

2-

(1) AA

(2) aa

(6) Aa

(7) Aa

(9) aa

Chapter (4) Classification of living organisms

Lesson (1) Principles of classification of living organisms



Living organisms are similar in functional and structural unit (Cell) and properties of life (Feeding, growth, reproduction, respiration, movement, sensation, excretion). But they are different in many things (Ex. life way – shape – structure – nutrition – the way of reproduction).

*→ Due to the diversity of living organisms, the need of **classification process** emerged. The science which studies the classification of living organisms is called **Taxonomy***

Taxonomy (Classification): *The science which studies the arrangement of living organisms according to their similarities and differences, which facilitates their study*

→ Greek philosopher Aristotle (lived 2300 years ago) was the first to classify animals into red-blooded and bloodless animals. He classified plants into shrubs, weeds and trees

→ Modern taxonomy depends mainly of the definition of species

Species: *A group of individuals having the same morphological characteristics which interbreed producing similar fertile individuals*

Tigon

*→ When female lion (lioness) and male tiger cross, they produce the so-called **tigons**. Tigons are infertile and cannot reproduce*



Fig. (1) Tigon

Mule

→ When a male donkey and female horse cross, they produce the so-called mules.

→ Mules are also infertile and cannot reproduce



Fig. (2) Mule

→ From the previous examples, we conclude that neither mule nor Tigon can be called species because they cannot interbreed (cross) and produce new fertile individuals.

Naming of living organisms

→ A living organism has different names in different languages, to overcome this problem, scientist **Carl Linnaeus** created a system to name living organisms, this system is called **Binomial system**, which is written in Latin language.

→ In binomial system, every organism has a binomial name, which is composed of two names:-

- 1st name: The name of **genus**, it begins with a capital letter
- 2nd name: The name of **species**, it begins with a small letter

→ Binomial names are written in Latin language in italics or underlined to be differentiated.

→ Linnaeus used Latin language because it is an old language not spoken by people, which protects it from any change or modification

Example:-

The scientific name (binomial name) of cat is *Felis domesticus*

- *Felis* is the name of genus, it means "Cat" in Latin
- *Domesticus* is the name of species, it means "domestic" in Latin

Taxonomic Hierarchy

There are seven classification levels in taxonomy, every level contains less animals with more similarity in characteristics, these levels are:-

1- Kingdom: contains a number of phyla (Singular phylum)

2- Phylum (Pl. Phyla): Represents a number of classes

3- Class: Contains a number of orders

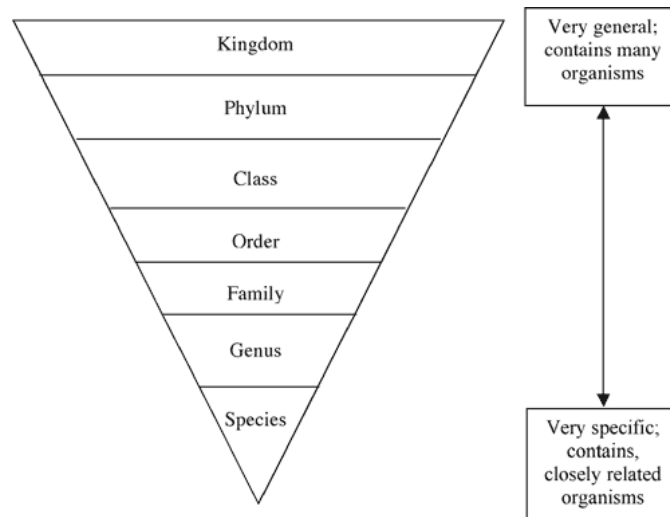
4- Order: Contains a number of families

5- Family: Contains a number of genres

6- Genus: Contains a number of species

7- Species: It contains individuals capable of producing fertile individuals

→ There are other groups between each two successive groups of the previously-mentioned levels (Ex. sub-phylum, sub-order, sub-family, sub-genus)



Dichotomous key

Dichotomous key: A series of characteristics arranged in pairs which helps the user determine the species of an unknown organism.

→ Dichotomous key begins with wide characteristics, and they become less more specific and definite as the level of the key increases. In each step, you can choose between two characteristics on basis of the living organism you search for.

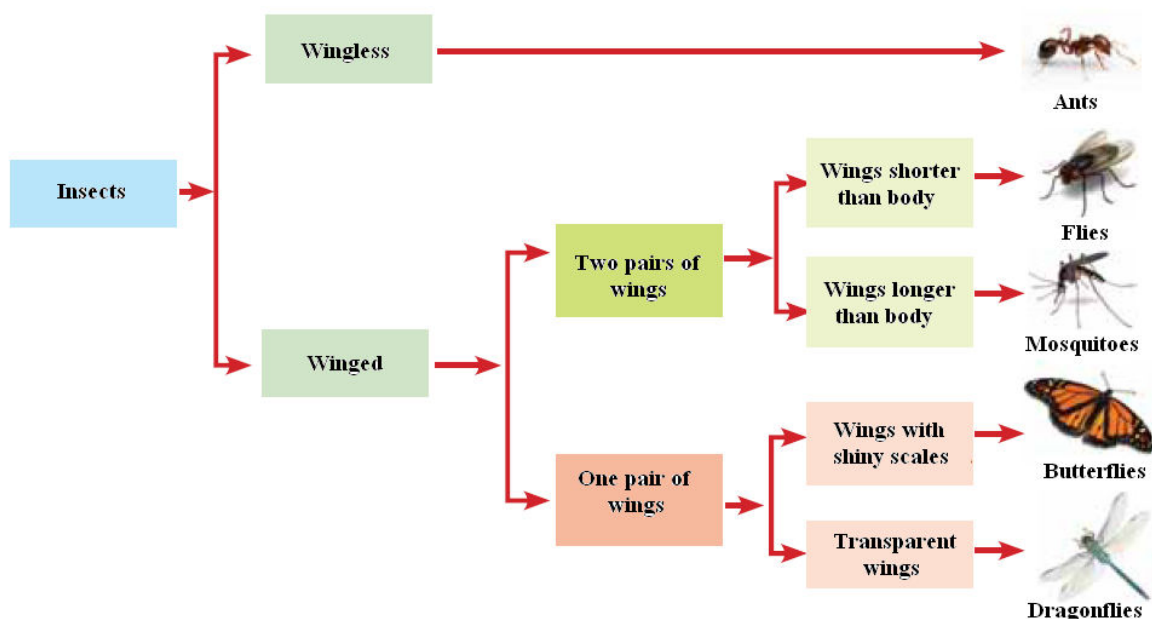


Fig. (3) Dichotomous key of some insects

Definitions of lesson (1)

Taxonomy (Classification): The science which studies the arrangement of living organisms according to their similarities and differences

Species: A group of individuals having the same morphological characteristics which interbreed producing similar fertile individuals

Dichotomous key: A series of characteristics arranged in pairs which helps the user determine the species of an unknown species

Give reasons for

1- The scientific importance of taxonomy (classification)

Because it deals with the arrangement of living organisms according to their differences and similarities, which facilitates their study.

2- The formation of tigers

Due to the interbreed of a female lion and male tiger

3- The formation of mules

Due to the interbreed of a male donkey and female horse

4- Neither tigers nor mules are species

Because both of them are infertile and cannot produce new fertile individuals, as they are resulted from the crossing of organisms of different species

5- The importance of binomial system of naming living organisms

Because it gives each organism a special scientific name, which overcame the problem of the difference of its names in different languages.

6- In binomial system, organisms names are derived from Latin language

Because Latin is an old language not spoken by people, which protects it from change or modification

7- The importance of dichotomous key

Because it helps us determine the species of an unknown organism through its characteristics

What happens when

1- A female lion and male tiger interbreed (cross)

Tigers are formed, which are organisms incapable of reproduction.

2- A female donkey and a male horse cross

Mules are formed, which are organisms incapable of reproduction

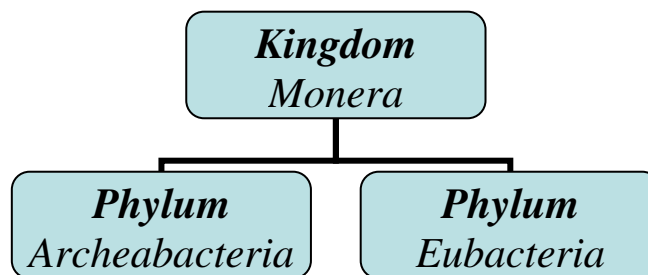
Lesson (2) Modern classification of living organisms



→ In 1700, Carl Linnaeus put the traditional classification system, which has only two kingdoms: Animal kingdom – Plant kingdom

→ On the grounds of the development of scientific techniques used in biology, scientist **Robert H. Whittaker** put a new classification system in 1969, this system was called Modern Classification. Whittaker classified living organisms into 5 kingdoms: Monera – Protista – Fungi – Plantae – Animalia

Kingdom Monera



General characteristics of Monera:-

- 1- Unicellular prokaryotic organisms
- 2- They live alone or in colonies
- 3- Their cell walls are devoid of cellulose or pectin
- 4- Their hereditary material is not surrounded by a nuclear membrane (doesn't have a definite nucleus)
- 5- Cytoplasm doesn't contain some organelles such as mitochondria, endoplasmic reticulum, plastids and Golgi bodies

For reading only The word Monera is derived from Latin language and means "Single", as they are the least developed organisms

Phylum Archeabacteria

Most of them live in extreme environmental conditions such as hot springs, environments empty of oxygen, highly-saline environments.

→ They are different from Eubacteria in the structure of cell wall and plasma membrane

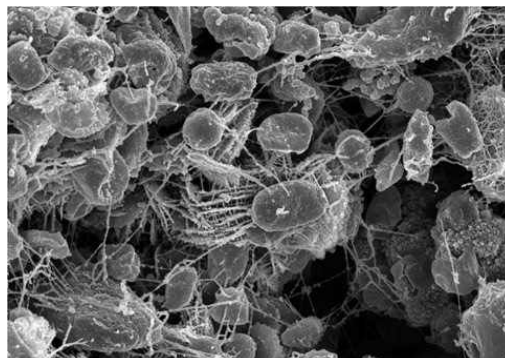


Fig. (4) Halophiles, an example on Archeabacteria

For reading only The word "Archeabacteria" is composed of two words: **Achaea** which means "Ancient", **Bacteria** which means "Rod" – as there are rod-shaped bacteria

Phylum Eubacteria

For reading only the prefix (Eu-) means good – as Eubacteria are more developed bacteria than Archeabacteria

→ They have many species which spread wildly in all the environments of earth, (air, water, ground...etc)

→ There are autotrophic bacteria (Ex. cyanobacteria), and there are heterotrophic bacteria (Ex. nostoc)

Autotrophs: Organisms which produce complex organic compounds from simple substances present in the surrounding – generally by photosynthesis process (Ex. plants)

Heterotrophs: Organisms which use organic carbon for growth from many sources (Ex. animals, humans)



Fig. (5) Cyanobacteria



Fig. (6) Nostoc

→ Bacteria reproduce asexually, they have different shapes (rod-shaped, spiral, spherical)

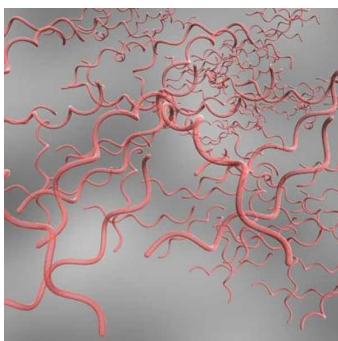


Fig. (7) Spiral

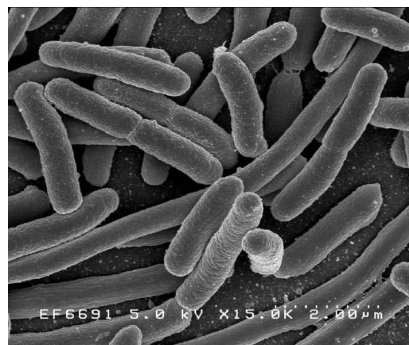


Fig. (8) Rod-shaped

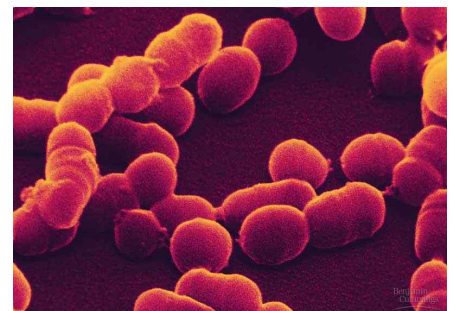
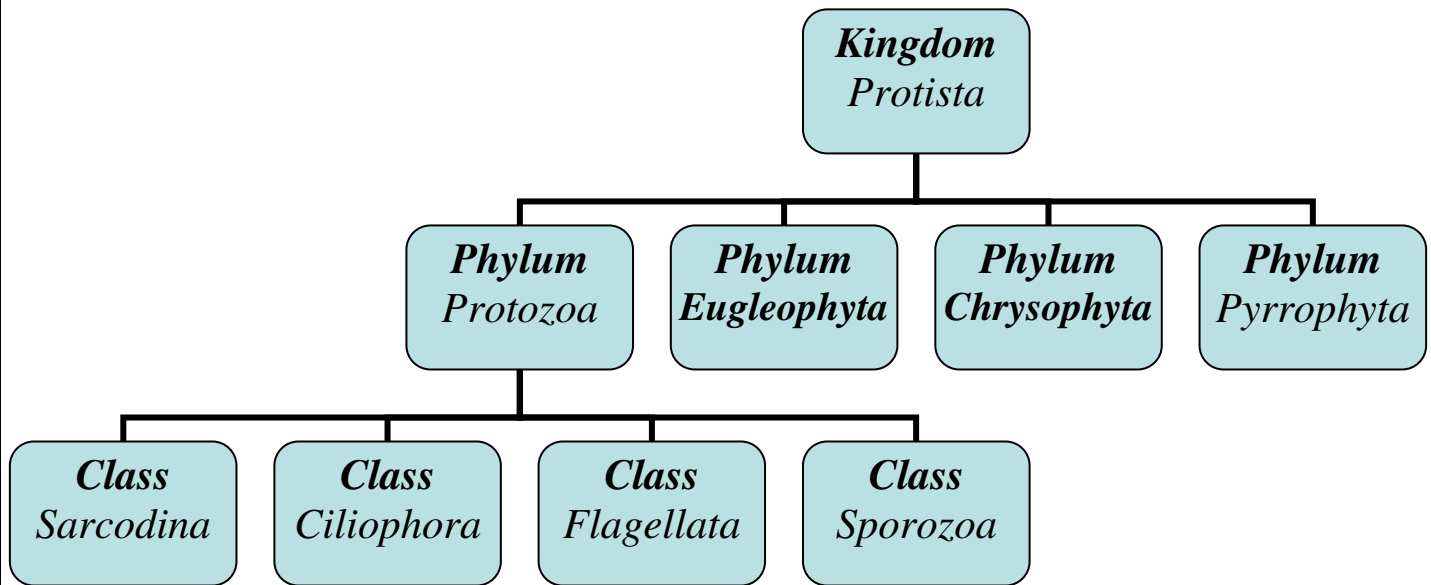


Fig. (9) Spherical bacteria

Kingdom Protista



For reading only The word "Protista" is derived from the Latin word "Proto-" which means "first" – as they are primitive organisms

Properties of Protista:-

- 1- Eukaryotic organisms
- 2- They are different from plants and animals, as they are not complex
- 3- Some of them have cell walls and plastids

Phylum Protozoa

Properties of protozoa:-

- 1- Unicellular microorganisms
- 2- They live in freshwater, salt water or fertile lands
- 3- They live alone or in colonies
- 4- Some of them parasite on animals and plants causing diseases
- 5- They reproduce sexually and asexually

Protozoa are classified according to their movement methods into:-

1- Class: Sarcodina

→ They move using temporary projections from the body called **Pseudopodia** (Ex. Amoeba)



Fig. (10) Amoeba, an example of Sarcodina

For reading only The word "Sarcodina" means "Flesh" – as Sarcodina like amoeba resembles flesh of meat

2- Class: Ciliophora

→ They move using cilia
(Ex. Paramecium)

For reading only Word "Ciliophora" consists of two words: "Cilio" which means "Cilia", and "phora" which means "bearer" – "Ciliophora" means "cilia bearer"
→ "Paramecium" means "oval" – as paramecium is oval-shaped

3- Class: Flagellata

→ They move using flagella
(Ex. Trypanosoma – Which causes sleeping disease)

For reading only Word "Flagellata" has two words, "Flagella" which means "scourge", and "-ata" which means "group"

4- Class: Sporozoa

→ They don't have a method for movement
→ They produce phases called Spores
(Ex. Plasmodium – which parasites on human causing malaria disease)

For reading only Word "Sporozoa" consists of two words: "Sproro" which means "spore" and "Zoa" which means "animal" - as Sporozoa produce spores
→ Plasmodium means "Mould"

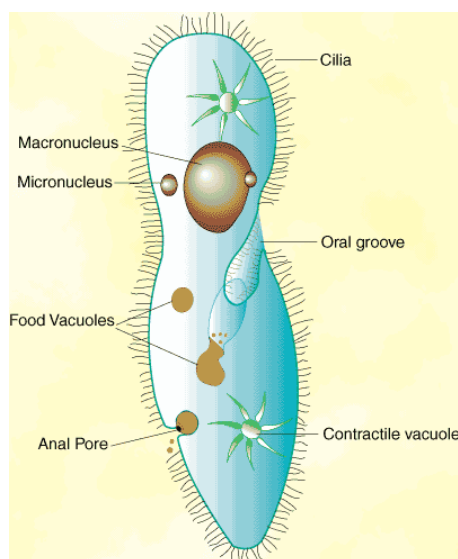


Fig. (10) Paramecium

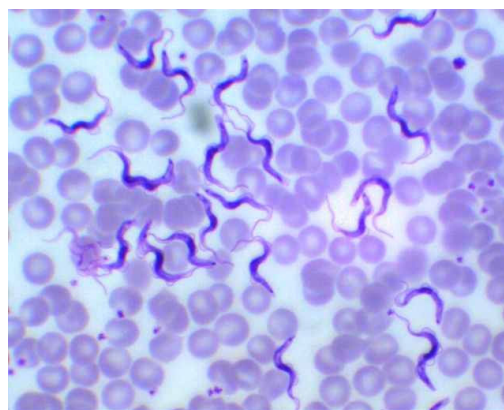


Fig. (11) Trypanosoma



Fig. (12) Plasmodium

Euglenophyta phylum:-

This phylum contains ***Euglena***

Properties of euglena

- 1- Unicellular organisms
- 2- They contain green plastids (chloroplasts) and perform photosynthesis
- 3- They move by flagella



Fig. (13) *Euglena*

Chrysophyta phylum

- Most of them are unicellular and called ***Diatoms***
- Diatoms have semi-glass cell wall containing Silica (*Silicon dioxide SiO₂*), they are a source of fish food

For reading only Chrysophyta is composed of two words "Chryso" which means "gold" and "phyta" which means plants (Golden plant)

Pyrrophyta phylum

For reading only "Pyrro" means fire, as Pyrrophyta resemble fire in colour

- These algae form a great part of phytoplanktons which live in seas and oceans.
- They have red colour due to the existence of red pigment along with chlorophyll
- ***Dinophlagellates*** is the greatest group of this phylum, its individuals move by two flagella



Fig. (14) *Diatoms*

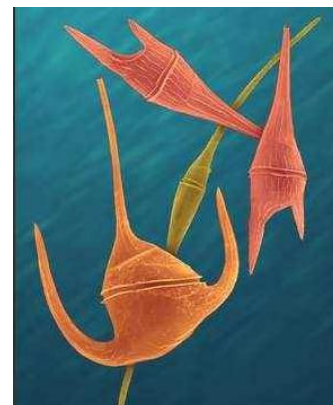
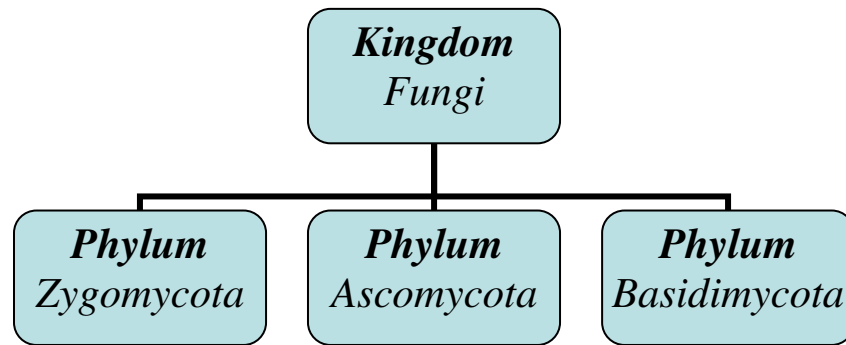


Fig. (15) *Pyrrophyta*

Kingdom Fungi



Characteristics of fungi:-

- 1- They are eukaryotes, some of them are unicellular and others are multicellular
- 2- They are immobile (cannot move) and their cell walls contain chitin
- 3- They are composed of filaments called **Hyphae**, which accumulate forming **Mycelium**
- 4- They may be autotrophic, heterotrophic or saprophytic
- 5- Most of them reproduce sexually, while the rest reproduce asexually by spores formation

For reading only "Hyphae" means "Web", as they look like spider webs
→ Mycelium means "fungi tissue"

Fungi are classified according to their structure of reproduction methods into:-

Phylum: Zygomycota

→ Their Hyphae are undivided and spores are produced in sporangium
(Ex. *Rhizopus nigricans*, which causes the black mould on bread and produces an enzyme used in cheese industry)

For reading only Zygomycota has two words, "Zygo" which means pairing, "mycota" which means fungi (Pairing fungi)

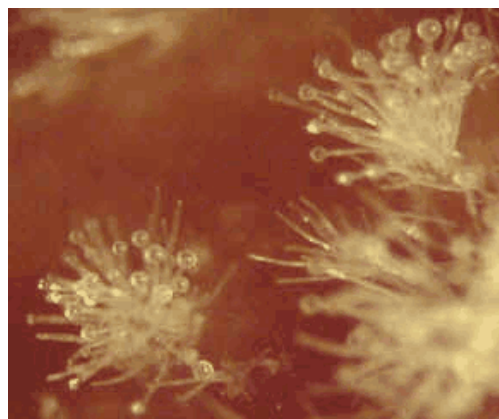


Fig. (16) *Rhizopus nigricans*

Phylum: Ascomycota

- Some of them are unicellular (Ex. yeast fungus)
- Some of them are multicellular and have *Hyphae* which are divided by transverse barriers called **Septa**, they produce spores inside *sporangia*. (Ex. *pencilium* fungus, which produces *penicillin* antibiotic)

For reading only "Asco-" means "sac", so Ascomycota means "sac-like fungi"

→ *Septa* means "Separate"

Phylum: Basidimycota

- Its *Hyphae* are divided, its spores may be produced in mace-like structure called **Cap**, some of them are edible (can be eaten by man) (Ex. *Mushroom*)

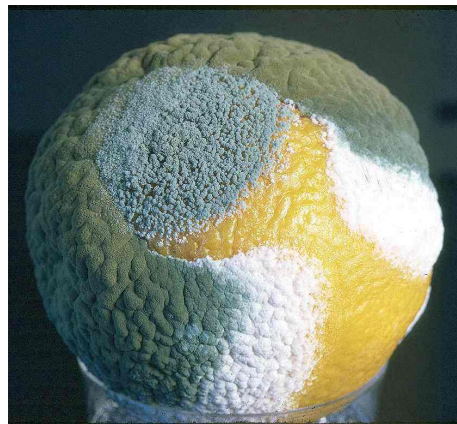


Fig. (17) *Pencilium* fungus

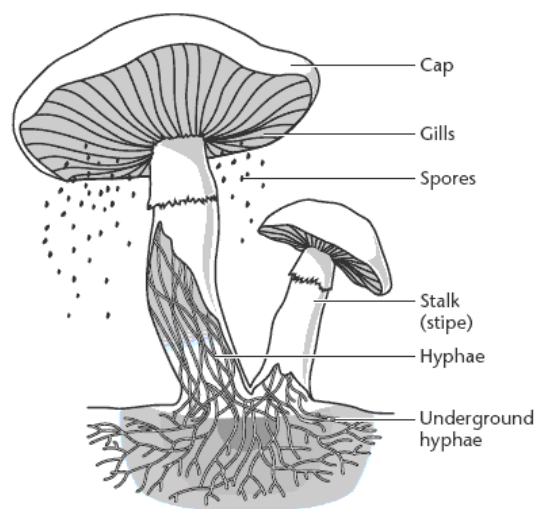
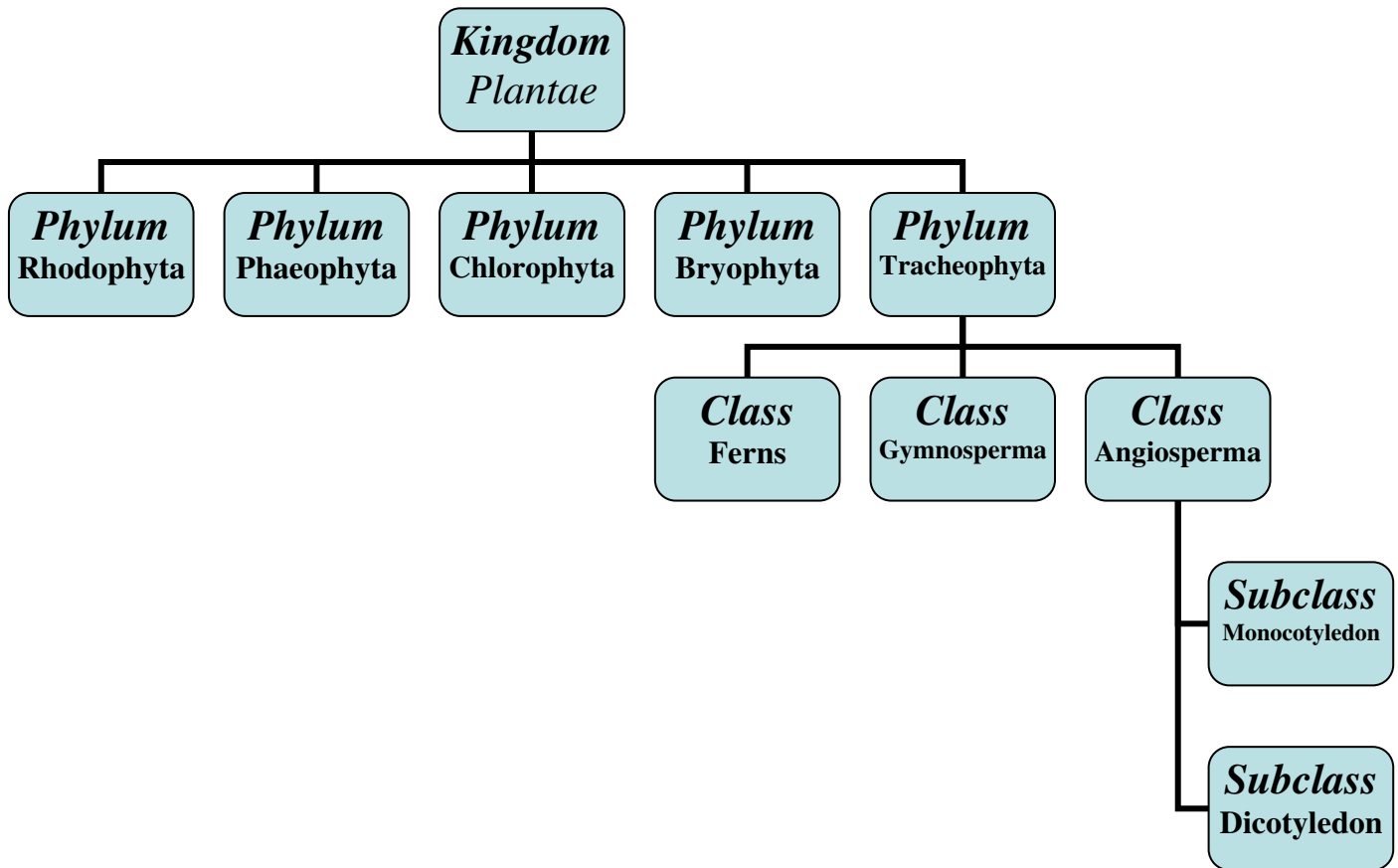


FIGURE 9.3. Parts of a Fungus

Fig. (18) *Mushroom* structure

For reading only "*Basidium*" is a spore-bearing structure which is found in some fungi. *Basisimycota* were called after it

Kingdom Plantae



Characteristics of plants:-

- 1- Eukaryotic organisms
- 2- Their cell walls contain cellulose
- 3- Their cells contain chlorophyll in green plastids
- 4- Most of them reproduce sexually

Most scientists of taxonomy see that kingdom Plantae is divided into:-

- A- High algae (Rhodophyta – Phaeophyta – Chlorophyta)
- B- Non vascular plants
- C- Vascular plants

A- High algae:-

Phylum: Rhodophyta

→ Marine weeds which are composed of filaments held together by a gelatinous (jelly-like) membrane, their cells have plastids carrying red pigments

Example: Polysiphonia algae

Phylum: Phaeophyta

→ Marine weeds which are composed of simple and branched filaments, their cells have plastids carrying brown pigments

Example: Fucus algae



Fig. (18) Polysiphonia algae



Fig. (19) Fucus algae

For reading only Polysiphonia consists of two words: "Poly" which means many, "Siphonia" which means "Sucking tube, blowing liquid"
 → "Fucus" means "sea weed"

Phylum: Chlorophyta

- Their cells have green plastids
- Some of them may be unicellular (Ex. Chlamydomonas)
- Some of them may be multicellular (Ex. Spirogyra)



Fig. (20) Spirogyra



Fig. (21) Chlamydomonas

For reading only "Rhodo-" means **red**, "Phaeo-" means **brown**, "Chloro-" means **green**. And "phyta" means plant

- Chlamydomonas consists of two words: "Chlamyda" which means cloak, "monas" which means "single-celled"
 - Spirogyra consist of two words: "Spiro" which means spiral, "gyra" means round
-

B- Non-vascular plants:-

Phylum: Bryophyta

- This phylum contains plants which don't have vascular tissues specific in transporting water and food, they are called **Non-vascular plants**
- Non vascular plants are terrestrial plants which need high humidity to grow up and reproduce. So, they live in damp and shady places.

→ Bryophyta are small green plants which have hairs for anchorage called rhizoids, some Bryophyta are flat (Ex. Ricca) and others are erect (Ex. Funaria)



Fig. (22) Ricca plant (flat)



Fig. (23) Funaria plant (erect)

C- Vascular plants:-

Phylum: Tracheophyta (Vascular plants)

For reading only "Trachea" is a vessel or duct in plant, "Phyta" means plant

→ Vascular plants (Tracheophyta) have Xylem tissues (which transports light and salt) and Phloem tissues (Which transports the organic substances produced from photosynthesis process), this phylum has 3 classes:-

1- Class: Ferns

→ Simple-structured plants, most of them are herbaceous (grass) and the rest are woody (trees). They live in damp and shady lands and exist in abundance on the walls of wells and damp valleys

→ They are differentiated into stems, roots and leaves. They have feather-like leaves, but do not have flowers.

→ They reproduce by spores which exist in special structures in the undersurface of their leaves

Example: Vougheir



Fig. (24) Feather-like leaf of Vougheir

2- Gymnospermae (Conifers)

→ They are vascular plants which do not form flowers, they have male and female reproductive organs called **cones**

→ Their seeds have no testa (pericarps) and their leaves are needle-shaped

Example: Pinus



Fig. (25) Pinus plant

For reading only Gymnosperms has two words: "Gymno" which means "naked, uncovered" and "Sperm" which means "seed"

3- Angiospermae (Flowering plants)

→ They are terrestrial plants which are differentiated into leaves, roots and stems. They form flowers which turn into fruits carrying seeds inside.

→ This class is divided into two classes: Monocotyledons – Dicotyledons

Subclass: Monocotyledons	Subclass: Dicotyledons
<ul style="list-style-type: none"> - Each seed has only one cotyledon - Leaf veins are parallel - Petals (flower parts) are in multiples of three - Bundles of vascular tissues are scattered through the stem - fibrous roots <p>Examples: Wheat – Corn – Onion – Cactus – Banana – Palm – Lily</p>	<ul style="list-style-type: none"> - Each seed has two cotyledons - Leaf vein are reticulated (branched) - Petals (flower plants) are in multiples of four or five - Bundles of vascular tissues are arranged across the stem in a ring - tap roots <p>Examples: Pea – bean – cotton – flower – orange ... etc</p>

	Seeds	Leaves	Flowers	Stem	Roots
Monocotyledons					
Dicotyledons					

Fig. (26) Comparison between monocotyledons and Dicotyledons

Definitions of lesson (2)

Monera: They are prokaryotic unicellular organisms whose cell walls are free from cellulose or pectin, they are devoid of many membranous cytoplasmic organelles.

Protista: They are eukaryotic organisms whose structure is not complex, some of them have plastids and cell walls, and a small number of them are multicellular

Sarcodina: A class of Protista whose individuals move by using temporary projections from the body called pseudopodia such as Amoeba

Ciliophora: class of Protista whose individuals move by using cilia such as paramecium

Flagellata: Class of Protista whose individuals move by using flagella such as Trypanosoma

Sporozoa: Class of Protista whose individuals do not have methods for movement and produce spores such as Plasmodium

Euglena: Unicellular organisms which belong to protists and move by using flagella, they can perform photosynthesis due to the presence of green plastids

Pyrrophyta: Phylum of Protista whose individuals are algae which form great part of phytoplanktons which live in seas and oceans, their cells have plastids carrying red pigments.

Fungi: Kingdom of immobile eukaryotic living organisms whose cell walls contain chitin, they reproduce sexually and asexually and composed of filaments called Hyphae

Hyphae (sing. Hypha): Group of filaments which forms the mycelium of fungi

Zygomycota: Phylum of fungi whose Hyphae are not divided, they reproduce by the formation of spores inside sporangia

Ascomycota: Phylum of fungi whose Hyphae are divided by transverse barriers called septa, they produce spores inside sporangia

Rhodophyta: Marine weeds which are composed of filaments held together by a gelatinous (jelly-like) membrane, their cells have plastids carrying red pigments such as Polysiphonia

Phaeophyta: Marine weeds which are composed of simple and branched filaments, their cells have plastids carrying brown pigments such as Fucus

Bryophyta: They are terrestrial plants which do not have vascular tissues, they need high humidity for growth and reproduction

Ferns: Simple-structured plants which have vascular tissues, they live in damp lands and reproduce by spores.

Gymnosperms (conifers): They are vascular plants which do not form flowers and have male and female reproductive organs called cones, their seeds have no testa and their leaves are needle-shaped

Angiosperms: They are terrestrial plants which are differentiated into leaves, roots and stems. They form flowers which turn into fruits carrying seeds inside.

Give reasons for

1- Cyanobacteria belong to kingdom Monera

Because:-

- 1- They are unicellular prokaryotic organisms
- 2- They live alone or in colonies
- 3- Their cell walls are devoid of cellulose or pectin
- 4- Their hereditary material is not surrounded by a nuclear membrane (doesn't have a definite nucleus)
- 5- Cytoplasm doesn't contain some organelles such as mitochondria, endoplasmic reticulum, plastids and Golgi bodies

2- Amoeba belongs to phylum Sarcodina in Protista

Because they move by using temporary projections from the body called pseudopodia

3- Trypanosoma is harmful for humans

Because Trypanosoma parasites on humans causing sleeping disease

4- Plasmodium is harmful to humans

Because it causes malaria disease to them

5- Pyrrophyta (Dinophlagellates) are red-coloured

Because their cells have plastids containing red pigments

6- Mushroom is from fungi

Because:-

- 1- They are multicellular eukaryotes
- 2- They are immobile (cannot move) and their cell walls contain chitin
- 3- They are composed of filaments called Hyphae, which accumulate forming Mycelium

7- *Rhizopus nigricans* is from Zygomycota

Because their Hyphae are not divided and they produce spores inside sporangia

8- Mushroom is from Basidiomycota

Because its Hyphae are divided and its spores are formed inside a mace-like structure called cap

9- Corn is from plants

Because:-

- 1- It is a eukaryotic organism*
- 2- its cell walls contain cellulose*
- 3- its cells contain chlorophyll in green plastids*
- 4- it reproduces sexually*

9- *Polysiphonia* algae is from Rhodophyta

Because it is from marine weeds whose filaments are held together by a gelatinous membrane and its cells contain plastids carrying red pigment

10- *Riccia* is from Bryophyta

Because Riccia doesn't have vascular plants which transport food and water, they are small green plants which have hair for anchorage called Rhizoids

11- *Vougheir* belongs to ferns

Because it is differentiated into stems, leaves and roots, but doesn't form flowers of seeds. They reproduce by the formation of spores in structures on the undersurface of its leaves

12- *Pinus* plant belongs to gymnosperms (conifers)

Because it doesn't form flowers and has female or male reproductive organs called cones. Its seeds has not testa and it has needle-shaped leaves

13- Monocotyledons are from angiosperms

Because they are terrestrial plants which have stems, leaves and roots, and they form flowers which turn into fruits carrying seeds.

14- Banana is from monocotyledons

Because its seed has only one cotyledon, its leaves veins are parallel, its petals exist in multiples of 3, bundles of its vascular tissues are scattered through the stems and its roots are fibrous

15- Cotton is from Dicotyledons

Because its seed has two cotyledon, its leaves veins are reticulated, its petals exist in multiples of 4 or 5 , bundles of its vascular tissues are arranged across the in a ring and its roots are taproot

What happens when

1- Trypanosome parasite reaches to human blood

This will cause the infection with sleeping disease

2- Plasmodium parasite phases reach to human blood

This will cause the infection with malaria disease

3- Leaving a wet piece of bread in a damp and warm place for some days

Rhizopus nigricans fungus (bread mould) is formed, which rotten this piece of bread.

Questions

1- Choose the correct answer

1- was the first to classify animals into red-blooded and bloodless animals

A- Socrates B- Aristotle C- Linnaeus D- Leeuwenhoek

2- put the traditional classification system

A- Aristotle B- Leeuwenhoek C- Linnaeus D- Robert Whittaker

3- put modern classification system

A- Robert Brown B- Aristotle C- Charles Darwin D- Robert Whittaker

4- Kingdom individuals are prokaryotes

A- Monera B- Protista C- Animalia D- Plantae

5- are prokaryotes which live in extreme environmental conditions

A- Eubacteria B- Achaeabacteria C- Rhodophyta D- Sporozoa

6- is an example of Eubacteria

A- Amoeba B- Pencilium C- Nostoc D- Euglena

7- are from autotrophic bacteria

A- Nostoc B- Amoeba C- Cyanobacteria D- Paramecium

8- are from heterotrophic bacteria

A- Nostoc B- Amoeba C- Cyanobacteria D- Paramecium

9- moves by using pseudopodia

A- Amoeba B- Trypanosome C- Plasmodium D- Paramecium

10- moves by using cilia

A- Amoeba B- Trypanosome C- Plasmodium D- Paramecium

11- moves by using flagella

A- Amoeba B- Trypanosome C- Plasmodium D- Paramecium

- 12- causes sleeping disease in human
A- Amoeba B- Trypanosome C- Plasmodium D- Paramecium
- 13- causes malaria in human
A- Amoeba B- Trypanosome C- Plasmodium D- Paramecium
- 14- belong to Chrysophyta phylum – kingdom Protista
A- Amoeba B- Diatoms C- Dinophlagellates D- Euglena
- 15- Belong to Pyrrophyta phylum – kingdom Protista
A- Amoeba B- Diatoms C- Dinophlagellates D- Euglena
- 16- Diatoms cell walls contain Substance
A- Pectin B- Cellulose C- Silica D- Lignin
- 17- Is from Zygomycota
A- Pencium B- Rhizopus nigricans C- Mushroom D- Yeast fungus
- 18- is from Ascomycota
A- Pencium B- Rhizopus nigricans C- Mushroom D- Yeast fungus
- 19- is from unicellular Ascomycota
A- Pencium B- Rhizopus nigricans C- Mushroom D- Yeast fungus
- 20- is from multicellular Ascomycota
A- Pencium B- Rhizopus nigricans C- Mushroom D- Yeast fungus
- 21- is from Basidimycota
A- Pencium B- Rhizopus nigricans C- Mushroom D- Yeast fungus
- 22- secretes enzyme which is used in cheese industry
A- Pencium B- Rhizopus nigricans C- Mushroom D- Yeast fungus
- 23- is known as bread mould
A- Pencium B- Rhizopus nigricans C- Mushroom D- Yeast fungus
- 24- is an example of Rhodophyta
A- Polysiphonia B- Fucus C- Chlamydomonas D- Vougheir
- 25- Fucus algae belong to
A- Rhodophyta B- Chlorophyta C- Phaeophyta D- Bryophyta
- 26- is from unicellular Chlorophyta
A- Spirogyra B- Fucus C- Chlamydomonas D- Vougheir

- 27- is from multicellular Chlorophyta
A- Spirogyra B- Fucus C- Chlamydomonas D- Vougheir
- 28- is an example of erect Bryophyta
A- Funeria plant B- Ricca C- Vougheir D- Pinus
- 29- is an example of flat Bryophyta
A- Funeria plant B- Ricca C- Vougheir D- Pinus
- 30- Yeast belongs to kingdom
A- Animalia B- Plantae C- Protista D- Fungi
- 31- is from conifers
A- Funeria plant B- Ricca C- Vougheir D- Pinus
- 32- Vougheir is from
A- Gymnosperma B- Bryophyta C- Angiosperma D- Ferns
- 33- is from monocotyledons
A- Banana B- Pea C- Cotton D- Bean

2- Write the scientific terms

- 1- They are prokaryotic unicellular organisms whose cell walls are free from cellulose or pectin, they are devoid of many membranous cytoplasmic organelles.
- 2- They are eukaryotic organisms whose structure is not complex, some of them have plastids and cell walls, and a small number of them are multicellular
- 3- A class of Protista whose individuals move by using temporary projections form the body called pseudopodia
- 4- class of Protista whose individuals move by using cilia such as paramecium
- 5- Class of Protista whose individuals move by using flagella
- 6- Class of Protista whose individuals do not have methods for movement and produce spores
- 7- Unicellular organisms which belong to protists and move by using flagella, they can perform photosynthesis due to the presence of green plastids
- 8- Phylum of Protista whose individuals are algae which form great part of phytoplanktons which live in seas and oceans, their cells have plastids carrying red pigments.
- 9- Kingdom of immobile eukaryotic living organisms whose cell walls contain chitin, they reproduce sexually and asexually and composed of filaments called Hyphae

10- Group of filaments which forms the mycelium of fungi

11- Phylum of fungi whose Hyphae are not divided, they reproduce by the formation of spores inside sporangia

12- Phylum of fungi whose Hyphae are divided by transverse barriers called septa, they produce spores inside sporangia

13- Marine weeds which are composed of filaments held together by a gelatinous (jelly-like) membrane, their cells have plastids carrying red pigments such as Polysiphonia

14- Marine weeds which are composed of simple and branched filaments, their cells have plastids carrying brown pigments

15- They are terrestrial plants which do not have vascular tissues, they need high humidity for growth and reproduction

16- Simple-structured plants which have vascular tissues, they live in damp lands and reproduce by spores.

17- They are vascular plants which do not form flowers and have male and female reproductive organs called cones, their seeds have no testa and their leaves are needle-shaped

18- They are terrestrial plants which are differentiated into leaves, roots and stems. They form flowers which turn into fruits carrying seeds inside

3- Write short notes about

1- Bryophytes

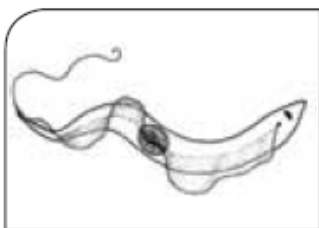
2- Ferns

3- Pyrrophyta

4- Achaeabacteria

5- Eubacteria

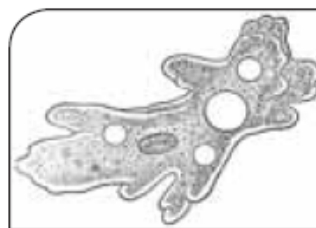
4- The following figures describe some living organisms, answer the questions



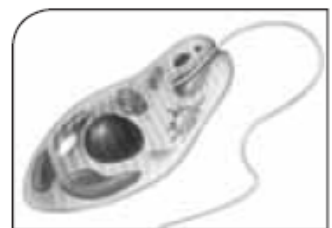
(A)



(B)



(C)



(D)

1- Determine the phyla and classes to which the previous organisms belongs

2- Mention the method of movement of the previous organisms

The Answers

1- Choose the correct answer

- | | |
|-----------------------|-------------------------------|
| 1- Aristotle | 17- <i>Rhizopus nigricans</i> |
| 2- Linnaeus | 18- Yeast fungus |
| 3- Robert Whittaker | 19- Yeast fungus |
| 4- Monera | 20- <i>Pencilium</i> |
| 5- Archeabacteria | 21- Mushroom |
| 6- Nostoc | 22- <i>Rhizopus nigricans</i> |
| 7- Cyanobacteria | 23- <i>Rhizopus nigricans</i> |
| 8- Nostoc | 24- <i>Polysiphonia</i> |
| 9- Amoeba | 25- <i>Phaeophyta</i> |
| 10- <i>Paramecium</i> | 26- <i>Chlamydomonas</i> |
| 11- Trypanosome | 27- <i>Spirogyra</i> |
| 12- Trypanosome | 28- <i>Ricca</i> |
| 13- <i>Plasmodium</i> | 29- <i>Funeria plant</i> |
| 14- Diatoms | 30- Fungi |
| 15- Dinophlagellates | 31- <i>Pinus</i> |
| 16- Silica | 32- <i>Gymnosperma</i> |
| 33- Banana | |

2- Write the scientific term

- | | |
|----------------------------|--------------------------|
| 1- Monera | 9- Fungi |
| 2- Protista | 10- Hyphae (sing. Hypha) |
| 3- Sarcodina | 11- Zygomycota |
| 4- Ciliophora | 12- Ascomycota |
| 5- Flagellata | 13- Rhodophyta |
| 6- Sporozoa | 14- <i>Phaeophyta</i> |
| 7- Euglena | 15- Bryophyta |
| 8- Pyrrophyta | 16- Ferns |
| 17- Gymnosperms (conifers) | |
| 18- Angiosperms | |

3- Write short notes about

1- This phylum contains plants which doesn't have vascular tissues specialized in transporting water and food, they are called Non-vascular plants. Non vascular plants are terrestrial plants which needs high humidity to grow up and reproduce. So, they live in damp and shady places

2- Simple-structured plants, most of them are herbaceous (grass) and the rest are woody (trees). They live in damp and shady lands and exist in abundance on the walls of wells and damp valleys. They are differentiated into stems, roots and leaves. They have feather-like leaves, but do not have flowers. They reproduce by spores which exist in special structures in the undersurface of their leaves

3- These algae form a great part of phytoplanktons which live in seas and oceans. They have red colour due to the existence of red pigment along with chlorophyll. Dinophlagellates is the greatest group of this phylum, its individuals move by two flagella

4- They belong to kingdom Monera. Most of them live in extreme environmental conditions such as hot springs, environments empty of oxygen, highly-saline environments. They are different from Eubacteria in the structure of cell wall and plasma membrane

5- They belong to kingdom Monera. They have many species which spread wildly in all the environments of earth, (air, water, ground...etc) There are autotrophic bacteria (Ex. cyanobacteria), and there are heterotrophic bacteria (Ex. nostoc)

4- The following figures describe some living organisms, answer the questions

1-

(A) Trypanosome: (Kingdom Protista – Phylum Protozoa – Class Flagellata)

(B) Paramecium: (Kingdom Protista – Phylum Protozoa – Class Ciliophora)

(C) Amoeba: (Kingdom Protista – Phylum Protozoa – Class Sarcodina)

(D) Euglena: (Kingdom Protista – Phylum Euglenophyta)

2-

(A) Flagella (B) Cilia (C) Pseudopodia (D) Flagella

Lesson (3) Kingdom Animalia



Kingdom Animalia

Characteristics of animals:-

- 1- They are multicellular eukaryotes
- 2- They have the ability to move and transport
- 3- They have the ability to quickly respond to outer environmental stimuli
- 4- Most of the reproduce sexually

→ Kingdom Animalia was divided into 9 phyla according to their structure complexity. Some of these phyla have vertebral column and called Vertebrates, while those which do not have vertebral columns are called invertebrates

1- Phylum Porifera (Sponges)

Sponges: They are simple-structured immobile living organisms which have unsymmetrical bodies containing many pores and canals

Characteristics of sponges:-

- 1- Sponges may be flask-shaped or tube-shaped
- 2- The body of a sponge is hollow and has a wall containing many pores and canals. So, sponges are also known as **Porifera** (*Porifera means pores bearer*)
- 3- The exist alone of in colonies
- 4- Body wall is supported by fibres, spicules or both of them
- 5- Most of them are hermaphrodite and reproduce sexually by fusion of gametes.
- 6- Some of them reproduce asexually by budding and regeneration

Example: Sponge animal



Fig. (27) Sponges

- Sponges are classified as animals though they are immobile because they are multicellular heterotrophic organisms whose cells lack cell walls
- They have few specific cells

2- Phylum Cnidaria

Cnidaria: Aquatic animals whose bodies have radial symmetry and they have cindocytes

Characteristics of Cnidaria:-

- 1- Most Cnidaria are aquatic and live alone or in colonies
- 2- They don't have heads
- 3- Their bodies have a cavity called **vascular digestive cavity**, and the mouth is surrounded by extensions and projections called **tentacles**
- 4- Body cells are arranged in two layers, the outer layers have stinging cells (cindocytes), which protects the animal and helps it in hunting preys. Cindocytes number increases in tentacles

→ During the life cycle of Cnidaria, two forms of individuals appear, which are:-

- **Polyps:** They carry out all life functions except sexual reproduction
- **Medusae:** They are individuals responsible for sexual reproduction, they are usually mobile

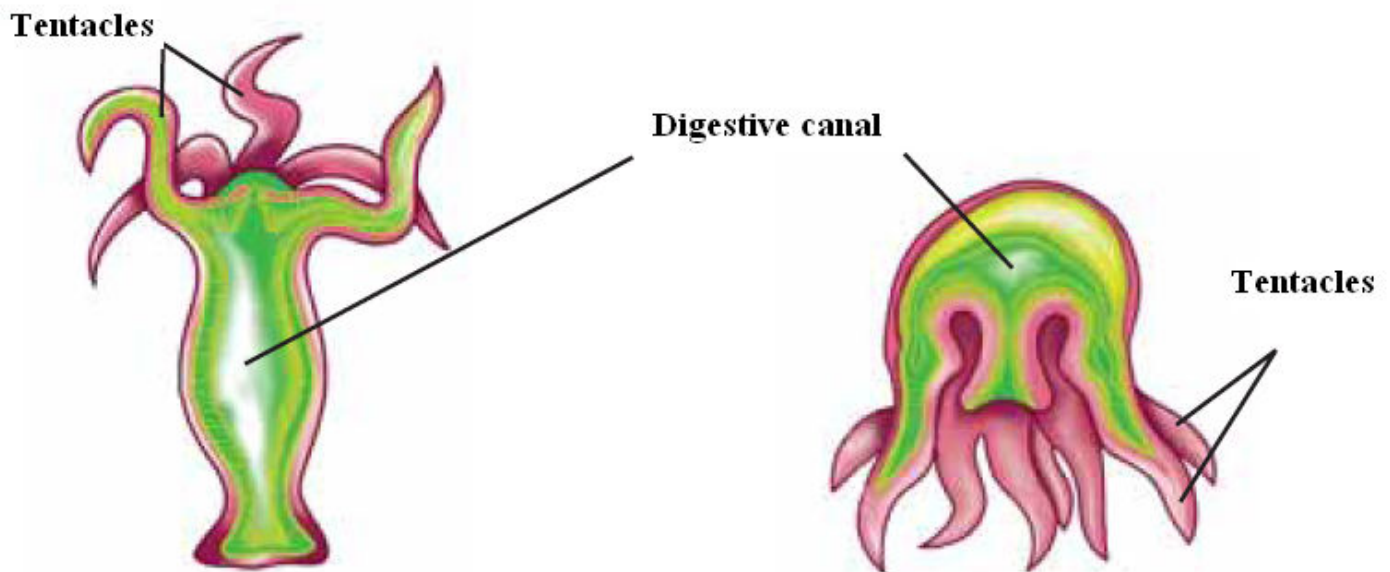


Fig. (28) Polyp and medusa phases of Cnidaria

→ In some Cnidaria, only polyps appear in their lives. In some of them, Medusae dominate over polyps or only both of them appear.

There are 3 classes of Cnidaria, which are:-

A- Class: Hydrozoa

→ Cnidaria in whose life cycles polyps dominate, most of them are aquatic and live in colonies. The rest of them live single in fresh water

Example: Hydra

B- Class: Scyphozoa

→ Cnidaria which spend most of their life in Medusa phase, they are aquatic animals which live in seas and oceans.

Example: Jellyfish

C- Class: Anthozoa

→ Cnidaria which don't have Medusa phase, all of them are aquatic and resemble flowers.

Example: Sea anemone – coral forming coral reefs



Fig. (29) Sea anemone



Fig. (30) Jellyfish



Fig. (31) Hydra

For reading only

→ Cnidaria means "nettle, sting"

→ Hydrozoa is composed of two words "Hydro" which means water, "Zoa" means animal

→ Scyphozoa is composed of two words "Schyphe" which means cup, "Zoa" which means animal, as scyphozoa resemble cups

→ Anthozoa is composed of two words "Antho" which means flower, "Zoa" which means animal, as Anthozoa resemble flowers

3- Phylum: Platyhelminthes

→ Platyhelminthes are also called flat worms

Characteristics of Platyhelminthes

- 1- Worms with flat bodies and head
- 2- Their bodies are formed from 3 layers and have lateral symmetry
- 3- Most of them are parasite, and the rest are free-living
- 4- Most of them are hermaphrodite, and the rest are unisexual

Flats worms have three classes, which are:-

1- Class: Turbellaria

→ Free-living worms, most of them live in fresh water and their lengths are few centimeters

Example: Planarian worm

2- Class: Trematoda

→ Worms which parasite on both humans and animals causing dangerous diseases.

Example: Bilharzias worm

3- Class: Cestoda

→ Parasite worms which live in the small intestine of humans and animals causing gastric disorders, anemia and weakness. They have tape-shaped bodies whose length may reach few meters.

Example: Tape worms

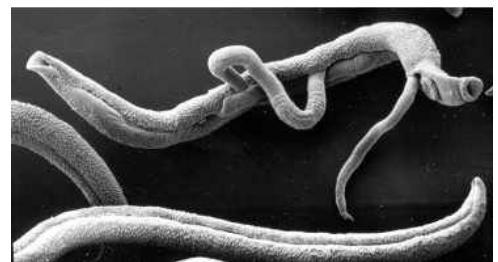


Fig. (31) Planarian Worm Fig. (32) Tape worm Fig. (33) Bilharzias worm

For reading only

- Platyhelminth is composed of two words "Platy" means flat, "helminth" worm
- Turbellaria is derived from word "turb" which means "disturb", as Turbellaria movement in water disturbs it
- Trematoda is derived from word "trema" which means hole, as they penetrate living organisms
- Cestoda means "stitched"

3- Phylum: Nematoda (Round worms)

Characteristics of nematoda (round worms)

- 1- They have cylindrical shapes with two ends tapered, their sizes range from microscopic range to few meters
- 2- Their bodies are formed from 3 layers and have lateral symmetry
- 3- They have alimentary canals with two openings: mouth and anus

4- Unisexual organisms

5- They live in all environments, some of them are free-living in water and soil, and the others parasite on animals, plants and humans

Examples: *Ascaris* worm – *Falaria* worm



Fig. (34) *Ascaris* worm

For reading only

→ Nematoda means "thread-like"

5- Phylum Annelida (ring worms)

→ They are earth worms which live inside soil in tunnels, they aerate the soil and increase its fertility

→ They are common examples of segmented worms, which have the following characteristics:-

1- They are free-living in salt water, freshwater and soil. Small no. of them are external parasites

2- Their bodies are divided into rings and have thorns in their skins which help them in movement

3- Some of them are unisexual, an a small no. are hermaphrodite

Examples: Earth worms – Medical leech



Fig. (35) Earth worms

6- Phylum Anthropoda

Characteristics of anthropoda:-

- 1- Their bodies are divided into a number of segments, some of these segments have paired identical appendages.
- 2- The segmented body is divided into many parts covered by exoskeleton

Anthropoda have 3 classes, which are:-

A- Class: Crustacea

Characteristics of crustacean:-

- 1- Their bodies consist of two parts (Cephalothorax – abdomen)
- 2- The body is covered with a chitinous cuticle
- 3- They have joint appendages which have different shapes to perform different functions and complex eyes
- 4- They breathe by gills

Examples: Shrimps – Crap – Crayfish



Fig. (36) Crap



Fig. (37) Shrimps

B- Class: Arachnida

Characteristics of Arachnida:-

- 1- Their bodies are divided into two regions (Cephalothorax - abdomen)
- 2- They have four pairs of legs for movement
- 3- They respire by book lungs or air trachea
- 4- They have simple eyes and they are unisexual

Examples: Spiders – Scorpions



Fig. (38) Scorpion



Fig. (39) Spider

C- Class: Insecta

Characteristics of insecta:-

- 1- Their bodies are divided into head, abdomen and chest (thorax)
- 2- They have a pair of complex eyes and two pairs of wings (which may be absent in some insects such as ants, or be only one pair as in domestic flies)
- 3- They breath by air trachea
- 4- They have three pairs of legs

Examples: Ants – Bees – Cockroaches – Locusts – Butterflies – Mosquito



Fig. (38) Mosquito



Fig. (39) Locust



Fig. (40) Bee



Fig.(41) Fly

D- Class: Myriapods

Characteristics of Myriapods:-

- 1- Their bodies are divided into a group of segments and consist of head and trunk
- 2- They have many legs
- 3- They breathe by air trachea

Examples: Caterpillar, which has 44 legs



Fig. (42) Caterpillar

For reading only

→ Cephalothorax is composed of two terms "Cephal" which means head or brain, "thorax" which means "chest, thorax". Cephalothorax consists of a head and thorax

→ Myriapods consists of two terms, "Myria" which means many, "pods" which means legs

7- Phylum Mollusca

Characteristics of Mollusca:-

- 1- Most of them live in salt water, some of them in freshwater and a small no. on the ground
- 2- They have soft bodies and has a muscular foot for movement
- 3- They have calcareous shells that may be external, internal, absent or unseen
- 4- They have heads (which carry sensation organs) and may be absent
- 5- They have an organ resembling tongue and carries teeth called **Radula**, which is used for feeding
- 6- Most of them are unisexual, and a small no. is hermaphrodite

Mollusca are divided into many classes

A- Class: Gastropoda

→ They move by gliding on the projection (extension) of the foot under their bodies, most of them have spiral shells composed of one piece. Some of them live in water and breathe by gills. And the others live on land and breathe by simple lungs

Example: Snails – Slugs

B- Class: Bivalvia

- The shells of these Mollusca are composed of two hinged parts
- All the individuals of this class are aquatic and breathe by gills

Example: Oyster – Mussel

C- Class: Cephalopoda

→ A part of their feet are modified into tentacles which exist in the head and away from the rest of the body

Examples: Octopus – squid



Fig. (33) Octopus



Fig. (34) Oyster



Fig. (35) Snail

For reading only

- (Gastro-) → Stomach, (Pod) → Foot. So, gastropod means (Stomach foot)
- (Bivalvia) → Double-valved (have two halves)
- (Cephal-) → Head, (Pod) → Foot. So, cephalopod means (Head foot)

8- Phylum Echinodermata

Characteristics of Echinodermata:-

- 1- The body is not divided (segmented) into parts, it has a solid endoskeleton
- 2- Many of them have prickles and calcareous plates (sheets) on the body wall
- 3- They have structures which resemble suckers called tube feet
- 4- The body may be cylindrical or star-shaped
- 5- They move by arms, prickles or tube feet
- 6- They are unisexual, they reproduce sexually by formation of gametes, and asexually by regeneration
- 7- They don't have anterior (front) or posterior (back) ends, but their bodies have two sides: Oral side (which has the mouth) – aboral side (opposite to oral side)

Echinodermata have 3 classes:-

A- Class: Asteroidea

→ They are animals with five or more arms which extend in a radial system from the central disc

Examples: Star fish

B- Class: Echinoidea

→ They are animals which do not have arms, but their bodies are covered with prickles (for movement and protection). They have five sharp peak-shaped teeth used in fragmentation and chewing of food.

Example: Sea Urchin

C- Class: Holothuroidea

→ They are animals which have soft and long bodies with no arms, their endoskeletons are reduced

Example: Sea cucumber



Fig. (36) Sea cucumber



Fig. (37) Sea urchin



Fig. (38) Starfish

For reading only

- (Echino-) → Hedgehog, (-Dermata) → Skin
 - (Aster-) → Star, (-oidea) → Animal
 - (Holothuroid) → A genus of animals in Latin, (oidea) → Animal
-

9- Phylum Chordata

Characteristics of Chordata

- 1- They are the most developed animals
- 2- Their fetuses have skeletal structures in their backs called "**Notochord**", which may stay inside the animal till its death. Notochord turn into vertebral column is most Chordata

(N.B: All the 8 phyla we mentioned before phylum Chordata belong to invertebrates, which do not have vertebral column)

Chordata phylum is divided into sub-phylum, the most important on of them is Sub-phylum vertebrata

Sub-Phylum Vertebrata

Characteristics of vertebrata:-

- 1- Notochord appears in them in embryonic stage. As the fetus grows up, notochord turns into vertebral column, which surrounds and protects the spinal cord.
- 2- They have endoskeletons composed of vertebral column, skull and limbs
- 3- Their hearts have many chambers
- 4- They have blood flowing in blood vessels in a closed cycle, which provides all body parts with oxygen and nutrients

Sub-phylum vertebrata has many classes:-

A- Class: Agnatha

Characteristics of Agnatha:-

- 1- They are fish which have a circular mouth resembling funnel, it has many teeth and no jaws
- 2- They have thin bodies resembling those of snakefish
- 3- They do not have double fins
- 4- They have cartilaginous skeletons
- 5- They are parasites which stick to big fish through their mouths, as they fix themselves to those fish by their teeth. They bite their meat by their rough tongues which resemble files

Example: Lampreys fish

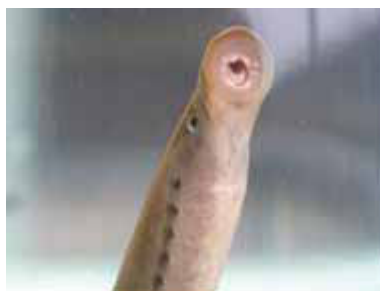


Fig. (39) Lampreys

For reading only

→ Lamprey is derived from Latin verb "Lampere" → which means lick
→ Agnatha is composed of two terms: "A-" which means without, "gnathos" which means jaw. Agnatha means "Without jaws"

B- Class: Chondrichthyes (cartilaginous fish)

Characteristics of Chondrichthyes

- 1- They are aquatic fish with cartilaginous endoskeleton
- 2- Their mouths are located in the abdomen and has two jaws carrying some rows of teeth which help them in predation
- 3- They have double fins
- 4- Their bodies are covered with scales resembling teeth
- 5- They have air bladders in their bodies for floating on the surface of water
- 6- Their gill opening are not covered
- 7- They are unisexual (Sexes are separate), and fertilization is internal

Examples: Shark fish – Whiptail stingray



Fig. (40) Shark



Fig. (41) Whiptail stingray.

For reading only

→ Chondrichthyes is composed of two terms: (Chondr-) which means cartilage, (-ichthyes) which means fish. So, Chondrichthyes means "Cartilage fish"

C- Class: Osteichthyes (bony fish)

Characteristics of Osteichthyes

- 1- They are fish which live in both salt water and freshwater
- 2- They have bony endoskeletons, and their mouths are located in the body front
- 3- They have single and double (paired) fins
- 4- Their bodies are covered with bony scales
- 5- Their gill openings are covered with gill cover
- 6- They are unisexual (sexes are separate) and fertilization is external

Example: Bouri fish – Bolty fish



Fig. (41) Bolti fish



Fig. (42) Bouri fish

D- Class: Amphibia

Characteristics of Amphibia

- 1- They are cold-blooded animals*
- 2- They are have four limbs and have five fingers (pentadactyl)*
- 3- They are unisexual (sexes are separate), and fertilization is external*
- 4- In embryonic stages, they live in water and breathe by gills. The adult stage live on land and breathe air by lungs and skin*

Examples: Salamander – Toads – Frogs



Fig. (43) Frog



Fig. (44) Salamander

E- Class: Reptilia

Characteristics of Reptilia

- 1- Cold-blooded animals (their temp. is equal to that of environment they live in)*
- 2- Body is formed from four regions: Head – Neck – Trunk – Tail*
- 3- They have four limbs (Quadripartite) and weak five fingers (pentadactyl). Each finger ends with a horny claw*
- 4- Some reptile doesn't have limbs and move by creeping (Ex. snakes)*
- 5- They breath air by lungs*
- 6- Sexes are separate (unisexual) and fertilization is internal*
- 7- They lay eggs with skinny or calcareous peels*
- 8- Skins are dry and covered by thick horny scales, which may be horny plates*

Examples: Lizards – Chameleon – Gecko – Tortoise – Crocodile – Snakes



Fig. (45) Snakes



Fig. (46) Lizard



Fig. (47) Crocodile

F- Class Aves (Birds)

Characteristics of birds:-

- 1- Warm-blooded animals (they have constant temp.)
- 2- Their bodies are covered with feather
- 3- They have four limbs, the two forelimbs are modified to wings for flying, and each hind limb has four fingers with horny claws for climbing, movement, predation or swimming
- 4- Their bones are light and hollowed, sternum bone (a bone in the chest) is flat to fix the strong chest muscles which move the wings during flying
- 5- They breathe air by lungs, and their bodies have air sacs which stores additional air quantity during flying
- 6- Sexes are separate (unisexual) and fertilization is internal, they lay eggs

Examples: Pigeons – Swallows – Vultures – eagles – ostriches



Fig. (48) Swallow



Fig. (41) Ostrich



Fig. (42) Vulture

G- Class: Mammalia

Characteristics of Mammalia

- 1- They are hot-blooded animals
- 2- Their bodies have 4 parts: Head – Neck – Chest (Thorax) – Abdomen
- 3- Their skins are covered with hair
- 4- They have four polydactyl (five- fingered) limbs with nails, claws or hooves
- 5- They have differentiated non-similar teeth (Molars – Tusks – Incisors)

6- Sexes are separate (unisexual) and fertilization is internal

7- Most of them give birth, and they have mammary glands which secrete milk for babies

8- They breathe by lungs

Mammalia has three subclasses, which are:-

Subclass: Prototheria	Subclass: Methatheria	Subclass: Eutheria
- They do not give birth, but they lay eggs. Babies feed on milk secreted from mammary glands on the abdomen of mother. They have cloacal opening through which wastes and eggs emerge	- Young born is not fully developed. So mother has to keep it inside a pouch - Young born feeds by suckling milk secreted from nipples inside the pouch until it is fully developed	- They are placental organisms which are born fully developed from mother - They feed on milk secreted by mammary glands of mother
- Duck-billed platypus - Echidna	- Kangaroo	- They have many organisms (Ex. human)



Fig. (43) Duck-billed platypus



Fig. (44) Kangaroo

For reading only

(Proto-) → First (primitive) (-theria-) → Mammals (Meta- Changed)

(Eu-) → Real

→ Subclass Eutheria (real mammals) are divided into many orders:-

A- Order: Edentata (E- → without, Dentata → Teeth, Without teeth)

→ Most of them are without teeth, some of them have only front teeth

→ They have strong curved claws

Example: Armadillo – Sloth



Fig. (45) Armadillo

B- Order: Insectivora (-Vora → Eater, Insects eaters)

→ They feed on insects

→ Their front teeth extend like pincers for predation on two rows

Example: Hedgehog



Fig. (46) Hedgehog

C- Order: Carnivora (Carni- → Meat, Vora → eater, Meat eaters)

→ They have large pointed canines and feed on meat

→ Their front molars are sharp, and back molars are broad and crushing

→ They have sharp, strong and curved claws

Examples: Cat – Dog – Tiger – Fox – Wolf – Seal



Fig. (47) Dog



Fig. (48) Seal



Fig. (49) Tiger

D- Order: Perissodactyla (Perisso → Odd or uneven, Dactyla → Finger)

→ They are herbivorous animals (plant-eaters)

→ They have an odd number (1,3,5...etc) of fingers covered with horny hooves

→ They have large teeth, which are adapted for crushing food

Examples: Horse – Donkey – Zebra - Rhinoceros



Fig. (50) Zebra

E- Order: Artiodactyla (Artio → even, Dactyla → Finger)

→ They are herbivorous animals

→ They have an even number (2,4,6...etc) of fingers covered with horny hooves

Examples: Sheep – Goats – Giraffes – Gazelles – Camels



Fig. (51) Giraffe



Fig. (52) Camel



Fig. (53) Gazelle

F- Order: Cetacea (It means whales in Latin)

- They are huge aquatic animals which live in seas and oceans
- The two forelimbs are modified to paddles, they have no hind-limbs
- They breathe atmospheric air by lungs
- Sexes are separate, they give birth their babies suckle milk from mammary glands

Examples: Dolphins – Whales



G-Order: Rodentia (means gnawers in Latin)

- They have a pair of Incisors in both upper and lower jaws. These incisors are sharp as anvil
- They have long tails and small ears

Examples: Mice – Rats – Squirrel (Chipmunk) – Jerboa



H- Order: Lagomorpha (means rabbit-shaped in Latin)

- They have two pairs of incisors in the upper jaw and one pair in lower jaw
- They have short tails and long ears

Examples: Rabbits – Hares



I- Order: Chiroptera (Chiro → Hand, pteron → Wing, Have wings instead of hand)

- Their forelimbs are modified to wings, where the second and fifth fingers of each forelimb elongated, and skin extended from the body to these fingers
- They become active at night

Examples: Bats



J- Order: Proboscidea (Pro → in front, boscide → to feed)

- They have long muscular trunks
- The front teeth grow forming elephant's fangs



K- Order: Primates

- They are the most developed mammals
- They have two pairs of polydactyl limbs
- Thumb finger is away from the other fingers
- They have developed nervous system and big brains



Examples: Monkeys – Lemurs – Gorillas – Chimpanzee – Apes – Human (most developed living organisms)

→ There are other living organisms which do not subject to Robert Whittaker's classification because they have the characteristics of both living and non living things

Examples: Viruses – Viroids – Prions

Viruses

→ They link between living and non living things:-

Non living things characteristics in viruses :-

- They do not have any cell structures
- They appear in a crystalline form
- They cannot perform any vital processes outside host cell

Living organisms characteristics in viruses:-

- They have DNA or RNA
- They can multiply and reproduce inside host cell

→ Virus consists of:-

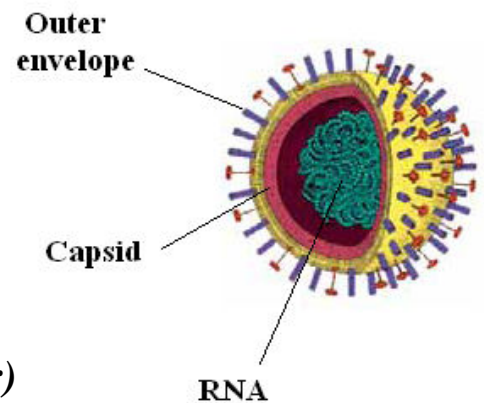
- 1- DNA or RNA
- 2- Protein coat called capsid

→ Viruses have very small sizes (20- 300 nanometer) and cannot be seen

→ Viruses have different shapes: they may be simple (rod-shaped, spiral, spherical, polyhedron) or very complex

→ Viruses are obligatory parasites: as they don't multiply or reproduce unless they are inside a host cell

→ Viruses are highly-specific organisms: Every virus has certain living organisms and cells. Viruses which attack plants cannot attack animals or humans, and those which attack the brain cannot attack the liver



Structure of flu virus

Viroids

- They are non-living organisms (pathogens – disease-causing) which are more simple than viruses
- They consist of small ring-shaped RNA strips in the form of double helix
- They do not have protein coat (capsid)
- Viroids enter the nucleus of the infected cell, and directs metabolism to produce more Viroids. They cause many diseases to plants such as:-
 - Potato spindle tuber disease
 - Cucumber pale fruit disease
- Viroids may spread quickly, but they cannot be determined because they do not destroy host cells like viruses

Prions

- Prions are non living organisms which are more simple than Viroids, as they are composed of only protein and do not have any nucleic acids.
- They spread inside the infected tissues of organisms causing disease which destroy their central nervous system, as they turn brain into a sponge-like mass full of pores like sieves. This may cause death
- Prions infection is common in sheep and livestock, they cause **mad cow disease**. Prions causes the infection of human with two diseases whose symptoms are like those of mad cow.
- Mad cow Prions can transfer to human from meat products of cows suffering from the disease (Hamburgers, sausages, cosmetics and medicine containing substances extracted from cows...etc)
- The transfer of Prions to human wasn't proved till now due to the extent of incubation period of mad cow disease in human

Science, technology and society

A- Modern techniques used in classifying living organisms

- In the past, scientists classified living organisms according to the similarities and differences between them according to shape
- Later (hundreds years ago), Scientists classified living organisms on the basis of determining the degree of similarity and difference between them (evolutionary relation), which depends on their researches on anatomy which:-
 - Determine the anatomic similarities
 - Determine the similarities in natural structures, such as skeletal and glandular structure.

- The study of embryonic development
- Nowadays, Scientists discovered new techniques by which we can find the similarities and differences of living organisms, this happened due to:-
 - The invention of electronic microscope, which developed microscopic techniques
 - The dramatic development of biochemical analysis
- Modern techniques of the classification of living organisms depends on the scientific researches about **DNA sequences** (which we studied in the previous chapter). Scientists discovered that the more similarity is between the sequence of DNA nucleotides of living organisms, the more alike are living organisms

B- New discoveries in biology

Extract of sponges:-

→ They play an important role in medicine and chemical industries, as scientists discovered new compounds in some sponges, which can be used as anti-cancer and antibiotics

Extract of jellyfish

→ Poisons by which jellyfish hunt their preys have many medical uses

Definitions of lesson (3)

Porifera (Sponges): Simple-structured animals which have unsymmetrical bodies with a lot of canals and pores

Cnidaria: They are animals with radial symmetry and have stinging cells (cindocytes)

Polyps: They are phases of Cnidaria which carry out all vital processes except sexual reproduction

Medusae: They are phases of Cnidaria which are responsible for sexual reproduction

Anthropoda: Animals whose bodies are divided into a number of segments which carry some pairs of appendages.

Mollusca: Animals having soft bodies covered by skin tissue called the mantle, which secretes a protective calcareous shell. It may be internal or external

Echinodermata: Animals which have solid endoskeletons and many of them have prickles and calcareous plats in their body walls

Chordata: A group of animals which have structures in their back called notochords

Viruses: Organisms which have the characteristics of both living and non living things

Give reasons for

1- Sponges are also called Porifera

Because the walls of their bodies have many canals and pores

2- Sponges are classified as animals although they cannot move

Because they are multicellular heterotrophic living organisms whose cells lack cell walls.

3- Cnidaria have cindocytes (stinging cells)

To protect them and help them in predation

4- Jellyfish is from Cnidaria

Because it live in the sea, it doesn't have a head, its body has a digestive cavity, its mouth is surrounded by tentacles and it has cindocytes for protection and predation

5- Hydra belongs to class hydrozoa of Cnidaria

Because in its life cycles, polyps dominate over Medusae

6- Jelly fish belong to class scyphozoa

Because they spend most of their life in medusa stage

7- Sea anemone belongs to class Anthozoa

Because its doesn't have Medusae stage and resembles flowers in shape

8- Planaria worm belongs to phylum Platyhelmenthes

Because it has flat body which have lateral symmetry and composed of 3 layers of tissues

9- Bilharzias worm belongs to Trematoda class

Because they parasite on humans causing dangerous diseases

10- Falaria (or Ascaris) worm belongs to phylum nematoda

Because it has round (cylindrical) shape and its alimentary canal has two openings: mouth – anus.

11- Shrimps belong to Curstacea

Because their bodies are divided into two parts (Cephalothorax – abdomen), their

Bodies are covered with chitinous cuticle and breathe by gills

12- Spiders are from arachnids

Because their bodies are divided into two parts (Cephalothorax – abdomen), they have four pairs of legs for movement and simple eyes

13- Ants are from insects

Because their bodies are divided into three parts (Head – thorax – abdomen), they have complex eyes and three pairs of legs for movement

14- Caterpillar is from Myriapods

Because they have numerous legs (44 legs)

15- Snails are from Mollusca

Because they have soft bodies covered with calcareous shells and muscular feet for movement. They have an organ resembling tongue called Radula

16- Oyster is from Bivalvia class of Mollusca

Because its shell is composed of two hinged parts, it lives in water and breathe by gills

17- Squids are from cephalopods of Mollusca

Because part of their feet are modified to tentacles which exist in the head away from the rest of the body.

18- Starfish is from Echinodermata

Because its body is not segmented and has solid endoskeleton, it is star-shaped, its body has two sides (Oral side – aboral side) and it reproduces asexually by regeneration

19- Sea urchin belongs to class Echinoidea

Because They are animals which do not have arms, but their bodies are covered with prickles (for movement and protection). They have five sharp peak-shaped teeth used in fragmentation and chewing of food.

20- The importance of vertebral column in vertebrata sub-phylum individuals

Because it surrounds and protects the spinal cord

21- Lampreys belong to class Agnatha

Because:-

- 1- They are fish which have a circular mouth resembling funnel, it has many teeth and no jaws*
- 2- They have thin bodies resembling those of snakefish*
- 3- They do not have double fins*

4- They have cartilaginous skeletons

5- They are parasites which stick to big fish through their mouths, as they fix themselves to those fish by their teeth. They bite their meat by their rough tongues which resemble files

22- Shark fish belong to class Chondrichthyes

Because:-

1- They are aquatic fish with cartilaginous endoskeleton

2- Their mouths are located in the abdomen and has two jaws carrying some rows of teeth which help her in predation

3- They have double fins

4- Their bodies are covered with scales resembling teeth

5- They have air bladders in their bodies for floating on the surface of water

6- Their gill opening are not covered

7- They are unisexual (Sexes are separate), and fertilization is internal

23- Bolty fish is from Osterichthyes

Because:-

- They have bony endoskeletons, and their mouths are located in the body front

- They have single and double (paired) fins

- Their bodies are covered with bony scales

- Their gill openings are covered with gill cover

- They are unisexual (sexes are separate) and fertilization is external

24- Salamanders belong to class Amphibia

Because:-

1- They are cold-blooded animals

2- They are have four limbs and have five fingers (pentadactyl)

3- They are unisexual (sexes are separate), and fertilization is external

4- In embryonic stages, they live in water and breathe by gills. The adult stage live on land and breathe air by lungs and skin

25- Chameleons belong to class Reptilia

Because:-

1- They are cold-blooded animals

2- Body is formed from four regions: Head – Neck – Trunk – Tail

3- They have four limbs (Quadripartite) and weak five fingers (pentadactyl). Each finger ends with a horny claw

4- Some reptile doesn't have limbs and move by creeping (Ex. snakes)

5- They breath air by lungs

6- Sexes are separate (unisexual) and fertilization is internal

7- They lay eggs with skinny or calcareous peels

8- Skins are dry and covered by thick horny scales, which may be horny plates

26- Ostriches are from birds (Aves)

Because:-

1- They are warm- blooded animals

2- Their bodies are covered with feather

3- They have four limbs, the two forelimbs are modified to wings for flying, and each hind limb has four fingers with horny claws for climbing, movement, predation or swimming

4- Their bones are light and hollowed, sternum bone (*a bone in the chest*) is flat to fix the strong chest muscles which move the wings during flying

5- They breathe air by lungs, and their bodies have air sacs which stores additional air quantity during flying

6- Sexes are separate (unisexual) and fertilization is internal, they lay eggs

27- Lions are from mammals (belong to class Mammalia)

Because:-

1- They are hot-blooded animals

2- Their bodies have 4 parts: Head – Neck – Chest (Thorax) – Abdomen

3- Their skins are covered with hair

4- They have four polydactyl (five- fingered) limbs with nails, claws or hooves

5- They have differentiated non-similar teeth (Molars – Tusks – Incisors)

6- Sexes are separate (unisexual) and fertilization is internal

7- Most of them give birth, and they have mammary glands which secrete milk for babies

8- They breathe by lungs

28- Duck-billed platypus belongs to subclass Prototheria

Because they do not give birth, but they lay eggs. Babies feed on milk secreted from mammary glands on the abdomen of mother. They have cloacal opening through which wastes and eggs emerge

29- Duck-billed platypus is the intermediate link between birds and mammals

Because it lays eggs and do not give birth (birds characteristics), but its babies feed by suckling the milk secreted from mammary glands on its abdomen (mammals characteristic)

30- Kangaroo belongs to Metatheria

Because it gives birth to not fully-developed babies, so it keeps them inside their pouch, where they suckle the milk secreted from its mammary glands until they become fully developed

31- Kangaroo puts his baby in a pouch

Because young born is not fully developed, so it is kept inside a pouch where its suckle the milk secreted from its mammary gland, until it becomes fully developed

32- Armadillo is a mammal which belongs to order Edentata

Because it doesn't have any teeth and have strong curved claws

33- Hedgehog is a mammal which belongs to order Insectivora

Because it feeds on insects and its front teeth are extended like pincers for predation

34- Dogs are mammals which belong to order Carnivora

Because they feed on meat, their front molars are sharp and back molars are broad and crushing and they have sharp and curved claws

35- Zebras are mammals which belong to order Perissodactyla

Because each limb has an odd number of fingers, which are covered with hooves. They also have large teeth for crushing food

36- Camels are mammals which belong to order Artiodactyls

Because each limb of it has an even number of fingers, which are covered with hooves.

37- Dolphins are mammals although they live in water

Because they feed their babies with milk secreted from mammary glands and they also have lungs for breathing atmospheric air

38- Mice are mammals which belong to order rodentia

Because they have a pair of jaws in each of the upper and lower jaws. They also have short ears and long tails

39- Rabbits are mammals which belong to order lagomorpha

Because they have two pairs of incisors in the upper jaw and one pair in the lower jaw. They also have long ears and short tails

40- Bats are mammals although they can fly

Because they give birth and have mammary glands

41- Viruses has the characteristics of both living and non living things

Non living things characteristics in viruses :-

- They do not have any cell structures
- They appear in a crystalline form
- They cannot perform any vital processes outside host cell

Living organisms characteristics in viruses:-

- They have DNA or RNA
- They can multiply and reproduce inside host cell

42- Viruses are obligatory parasites

Because they cannot reproduce unless they are inside host cell

43- It is hard to detect Viroids in infected cells

Because Viroids do not destroy the cells they parasite like viruses

44- Viroids are harmful to plants

Because some Viroids cause diseases to plants such as pale cucumber

Questions

1- Choose the correct answer

1- animal belongs to phylum Porifera

- A- Lampreys B- Sponges C- Jellyfish D- Bats

2- Animals of phylum has stinging cells

- A- Chordata B- Platyhelminthes C- Cnidaria D- Annelida

3- In the life cycle of, polyps dominate over Medusae

- A- Hydra B- Jellyfish C- Sea anemone D- Coral reef

4- In the life cycle of, Medusae dominate over polyps

- A- Hydra B- Jellyfish C- Sea anemone D- Coral reef

5- Planaria worm belongs to class of phylum Platyhelminthes

- A- Turbellaria B- Trematoda C- Cestoda D- Annelida

6- Ascaris worm belongs to phylum

- A- Nematoda B- Platyhelminthes C- Annelida D- Anthropoda

7- Crabs are from

- A- Crustaceans B- Insects C- Arachnids D- Myriapods

8- Caterpillar is from

- A- Crustaceans B- Insects C- Arachnids D- Myriapods

9- Bees belong to

- A- Crustaceans B- Insects C- Arachnids D- Myriapods

10- Scorpions belong to

- A- Crustaceans B- Insects C- Arachnids D- Myriapods

- 11- are animals whose shells are composed of two hinged parts
A- Octopus B- Mussel C- Slugs D- Squids
- 12- Sea urchin belongs to class of Echinodermata
A- Asteroids B- Echinoidea C- Holothuroidea D- Turbellaria
- 13- is from cartilaginous fish
A- Bouri B- Bolty C- Shark D- Shrimps
- 14- are from amphibians
A- Frogs B- Geckos C- Jerboa D- Snakes
- 15- Fetuses of phylum have notochords
A- Chordata B- Porifera C- Mollusca D- Anthropoda
- 16- is from Eutheria
A- Platypus B- Kangaroo C- Lions D- Chameleons
- 17- is from Prototheria
A- Human B- Lions C- Platypus D- Kangaroo
- 18- is an animal which lays eggs and has mammary glands
A- Platypus B- Kangaroo C- Lions D- Chameleons
- 19- animals have no teeth
A- Lampreys B- Lions C- Vultures D- Armadillo
- 20- Sloth belongs to order of Mammalia
A- Edentata B- Chiroptera C- Cetacea D- Primates
- 21- have an even no. of fingers in each limb
A- Rhinoceros B- Horses C- Donkeys D- Sheep
- 22- Zebras belong to order of Mammalia
A- Artiodactyla B- Chiroptera C- Perissodactyla D- Primates
- 23- animals belong to Rodentia order
A- Rats B- Rabbits C- Bats D- Flies
- 24- Elephants belong to Order
A- Edentata B- Chiroptera C- Proboscidea D- Primates

2- Write the scientific term

- 1- They are animals with radial symmetry and have stinging cells (cindocytes)

- 2- They are phases of Cnidaria which carry out all vital processes except sexual reproduction
- 3- They are phases of Cnidaria which are responsible for sexual reproduction
- 4- Animals whose bodies are divided into a number of segments which carry some pairs of appendages.
- 5- Animals having soft bodies covered by skin tissue called the mantle, which secretes a protective calcareous shell. It may be internal or external
- 6- Animals which have solid endoskeletons and many of them have prickles and calcareous plates in their body walls

3- Compare between

- 1- Cartilaginous and bony fish
- 2- Insects and arachnids
- 3- Annelida and Nematoda
- 4- Birds and reptiles

4- Classify the following living organisms

- 1- Spider
- 2- Jellyfish
- 3- Bilharzias worm
- 4- Octopus
- 5- Bean

The Answers

1- Choose the correct answer

- | | |
|----------------|--------------------|
| 1- Sponges | 13- Shark |
| 2- Cnidaria | 14- Frogs |
| 3- Hydra | 15- Chordata |
| 4- Jellyfish | 16- Lions |
| 5- Turbellaria | 17- Platypus |
| 6- Nematoda | 18- Platypus |
| 7- Crustaceans | 19- Armadillo |
| 8- Myriapods | 20- Edentata |
| 9- Insects | 21- Sheep |
| 10- Arachnids | 22- Perissodactyla |

11- Mussel

23- Rats

12- Echinoidea

24- Proboscidea

3- Compare between

1- Cartilaginous and bony fish

<i>Cartilaginous fish</i>	<i>Bony fish</i>
<ul style="list-style-type: none">- They have cartilaginous endoskeletons- Their bodies are covered with teeth-like scales- Their gill openings are not covered with gill cover- The fertilization is internal Ex. Whiptail stingray – Shark fish	<ul style="list-style-type: none">- They have bony endoskeletons- Their bodies are covered with bony scales- Their gill openings are covered with gill covers- The fertilization is external Ex. Bolty fish – Bouri fish

2- Insects and arachnids

<i>Insects</i>	<i>Arachnids</i>
<ul style="list-style-type: none">- Their bodies are divided into three parts (Head – thorax – Abdomen)- They have 3 pairs of legs- They have complex eyes Ex. Bees – Ants	<ul style="list-style-type: none">- Their bodies are divided into two parts (Cephalothorax – Abdomen)- They have 4 pairs of legs- They have simple eyes Ex. Spiders – Scorpions

3- Annelida and Nematoda

<i>Annelida</i>	<i>Nematoda</i>
<ul style="list-style-type: none">- They have round cylindrical shapes- Their bodies are divided into rings- Some of them are unisexual, others are hermaphrodite Ex. Earth worms	<ul style="list-style-type: none">- They are ring-shaped- Their bodies are formed from 3 layers- They are unisexual Ex. Ascaris worm – Falaria worms

4- Birds and reptiles

<i>Birds</i>	<i>Reptiles</i>
<ul style="list-style-type: none">- Warm-blooded animals- They have four limbs, forelimbs are modified to wings and hind-limbs have 4 fingers each Ex. Ostriches - Vultures	<ul style="list-style-type: none">- Cold-blooded animals- they have four limbs with 5 weak fingers, some of them don't have limbs are move by creeping Ex. Snakes - Chameleons

5- Classify the following organisms See classification dictionary page

Question (1)

A- Choose the correct answer

1- put the traditional classification system

A- Aristotle B- Leeuwenhoek C- Linnaeus D- Robert Whittaker

2- Diatoms cell walls contain Substance

A- Pectin B- Cellulose C- Silica D- Lignin

3- Is from Zygomycota

A- Pencilium B- Rhizopus nigricans C- Mushroom D- Yeast fungus3.

4- Ascaris worm belongs to phylum

A- Nematoda B- Platyhelmenthes C- Annelida D- Anthropoda

5- is an animal which lays eggs and has mammary glands

A- Platypus B- Kangaroo C- Lions D- Chameleons

B- Give reasons for

1- Bolty fish is from Osterichthyes

2- Bilharzias worm belongs to Trematoda class

3- Neither tigons nor mules are species

4- The importance of dichotomous key

5- Amoeba belongs to phylum Sarcodina in Protista

Question (2)

A- Write the scientific term

1- They are terrestrial plants which are differentiated into leaves, roots and stems. They form flowers which turn into fruits carrying seeds inside.

2- They are animals with radial symmetry and have stinging cells (cindocytes)

3- Group of filaments which forms the mycelium of fungi

4- Marine weeds which are composed of simple and branched filaments, their cells have plastids carrying brown pigments

5- They are terrestrial plants which do not have vascular tissues, they need high humidity for growth and reproduction

B- What happens when:-

1- A female donkey and a male horse cross

2- Trypanosome parasite reaches to human blood

3- Leaving a wet piece of bread in a damp and warm place for some days

4- *Plasmodium* parasite phases reach to human blood

Question (3)

A- Match

(A)	(B)
1- Eukaryotic heterotrophic organisms whose bodies are composed of filaments forming Mycelium	A- Mammals
2- Plants which reproduce by cones and their seeds have no testa	B- Porifera
3- Warm-blooded animals whose bodies are covered with feather	C- Amphibia
4- Cold-blooded animals whose embryonic stages breathe by gills and adults breath air by lungs	D- Birds
5- Simple-structured animals with pores and canals in their bodies	E- Conifers
	F- Fungi

B- Write short notes about

- 1- Bryophytes
- 2- Ferns
- 3- Pyrrophyta
- 4- Achaeabacteria

Question (4)

A- Correct the underlined words

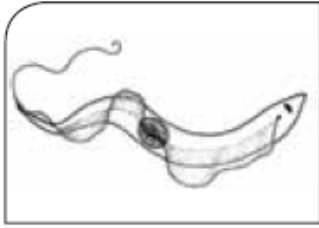
- 1- Carl Linnaeus put the modern classification system in 1969
- 2- Phylum is composed of a group of families
- 3- Amoeba causes sleeping disease
- 4- Jellyfish belongs to Eutheria order of Mammalia
- 5- Gecko is from insects

B- Compare between

- 1- Cartilaginous and bony fish
- 2- Insects and arachnids
- 3- Annelida and Nematoda
- 4- Monocotyledon and Dicotyledons

Question (5)

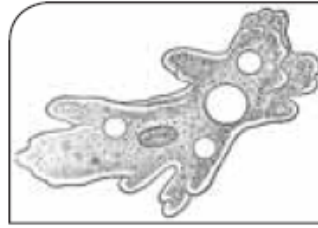
(A) The following figures describe some living organisms, answer the questions



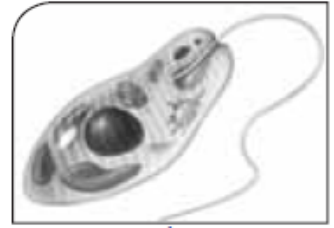
(A)



(B)



(C)



(D)

- 1- Determine the phyla and classes to which the previous organisms belongs
- 2- Mention the method of movement of the previous organisms

(B) classify the following living organisms:-

- 1- Spider
- 2- Human

Living organisms classification dictionary
Including all living organisms of biology curriculum

In alphabetical order

Letter (A)

Amoeba

(Kingdom Protista – Phylum Protozoa – Class Sarcodina)

Ants

(Kingdom Animalia – Phylum Anthropoda – Class insecta)

Apes

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: primates)

Armadillo

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: Edentata)

Ascaris

(Kingdom Animalia – Phylum: Nematoda)

Letter (B)

Banana

(Kingdom Plantae – Phylum Tracheophyta – class: Angiosperma – Subclass: Monocotyledon)

Bats

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: Chiroptera)

Bean

(Kingdom Plantae – Phylum Tracheophyta – class: Angiosperma – Subclass: Dicotyledon)

Bees

(Kingdom Animalia – Phylum Anthropoda – Class insecta)

Bilharzias worm

(Kingdom Animalia – Phylum: Platyhelmenthes – Class: Trematoda)

Bolty fish

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Osterichthyes)

Bouri fish

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Osterichthyes)

Bread mould

(Kingdom Fungi – Phylum: Zygomycota)

Butterflies

(Kingdom Animalia – Phylum Anthropoda – Class insecta)

Letter (C)**Cactus**

(Kingdom Plantae – Phylum Tracheophyta – class: Angiosperma – Subclass: Monocotyledon)

Camels

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: Perissodactyla)

Cat

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: Carnivora)

Caterpillar

(Kingdom Animalia – Phylum Anthropoda – Class: Myriapoda)

Chameleon

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: Reptilia)

Chipmunk

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: Rodentia)

Chimpanzee

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: primates)

Chlamydomonas

(Kingdom Plantae – Phylum: Chlorophyta)

Cockroach

(Kingdom Animalia – Phylum Anthropoda – Class insecta)

Corn

(Kingdom Plantae – Phylum Tracheophyta – class: Angiosperma – Subclass: Monocotyledon)

Cotton

(Kingdom Plantae – Phylum Tracheophyta – class: Angiosperma – Subclass: Dicotyledon)

Crabs

(Kingdom Animalia – Phylum Anthropoda – Class Crustacea)

Crayfish

(Kingdom Animalia – Phylum Anthropoda – Class Crustacea)

Crocodiles

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: Reptilia)

Cyanobacteria

(Kingdom Monera – Phylum: Eubacteria)

Letter (D)**Diatom**

(Kingdom Protista – Phylum: Chrysophyta)

Dinophlagellates

(Kingdom Protista – Phylum: Pyrrophyta)

Dog

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: Carnivora)

Dolphin

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: Cetacea)

Donkey

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: Perissodactyla)

Duck-billed platypus

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Prototheria)

Letter (E)**Eagle**

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: Aves (birds))

Earthworm

(Kingdom Animalia – Phylum Annelida)

Echidna

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Prototheria)

Elephant

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: Proboscidea)

Euglena

(Kingdom Protista – Phylum: Euglenophyta)

Letter (F)**Falaria worm**

(Kingdom Animalia – Phylum: Nematoda)

Fox

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: Carnivora)

Frog

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: Amphibia)

Fucus

(Kingdom Plantae – Phylum: Phaeophyta)

Funeria

(Kingdom Plantae – Phylum: Bryophyta)

Letter (G)**Gazelle**

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: Artiodactyla)

Gecko

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: Reptilia)

Gerbo

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: Rodentia)

Giraffes

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: Artiodactyla)

Goats

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: Artiodactyla)

Gorilla

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: primates)

Letter (H)

Hare

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: Lagomorpha)

Hedgehog

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: Insectivora)

Horse

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: Perissodactyla)

Human

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: primates)

Hydra

(Kingdom Animalia – Phylum Cnidaria – Class: Hydrozoa)

Letter (J)

Jellyfish

(Kingdom Animalia – Phylum Cnidaria – Class: Scyphozoa)

Jerboa → Gerbo

Letter (K)

Kangaroo

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Metatheria)

Letter (L)

Lampreys

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: Agnatha)

Lemurs

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: primates)

Lily

(Kingdom Plantae – Phylum Tracheophyta – class: Angiosperma – Subclass: Monocotyledon)

Lion

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: Carnivora)

Lizards

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: Reptilia)

Locusts

(Kingdom Animalia – Phylum Anthropoda – Class insecta)

Letter (M)**Mice**

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: Rodentia)

Monkey

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: primates)

Mosquito

(Kingdom Animalia – Phylum Anthropoda – Class insecta)

Mushroom

(Kingdom Fungi – Phylum: Basidimycota)

Mussel

(Kingdom Animalia – Phylum: Mollusca – Class: Bivalvia)

Letter (N)**Nostoc**

(Kingdom Monera – Phylum: Eubacteria)

Letter (O)**Octopus**

(Kingdom Animalia – Phylum: Mollusca – Class: Cephalopoda)

Onion

(Kingdom Plantae – Phylum Tracheophyta – class: Angiosperma – Subclass: Monocotyledon)

Ostrich

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: Aves (birds))

Orange

(Kingdom Plantae – Phylum Tracheophyta – class: Angiosperma – Subclass: Dicotyledon)

Oyster

(Kingdom Animalia – Phylum: Mollusca – Class: Bivalvia)

Letter (P)**Palm**

(Kingdom Plantae – Phylum Tracheophyta – class: Angiosperma – Subclass: Monocotyledon)

Paramecium

(Kingdom Protista – Phylum: Protozoa – Class: Ciliophora)

Pea

(Kingdom Plantae – Phylum Tracheophyta – class: Angiosperma – Subclass: Dicotyledon)

Pencilium

(Kingdom Fungi – Phylum Ascomycota)

Pigeons

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: Aves (birds))

Pinus

(Kingdom Plantae – Phylum: Tracheophyta – Class: Angiosperma)

Planaria

(Kingdom Animalia – Phylum: Platyhelmenthes – Class: Turbellaria)

Plasmodium

(Kingdom Protista – Phylum: Protozoa – Class: Sporozoa)

Platypus → Duck billed platypus

Polysiphonia

(Kingdom Plantae – Phylum: Rhodophyta)

Letter (R)**Rabbit**

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: Lagomorpha)

Rat

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: Rodentia)

Rhinoceros

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: Perissodactyla)

Rhizopus nigricans → Bread mould

Ricca

(Kingdom Plantae – Phylum: Bryophyta)

Letter (S)**Salamander**

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: Amphibia)

Scorpion

(Kingdom Animalia – Phylum: Anthropoda – Class: Arachnida)

Sea anemone

(Kingdom Animalia – Phylum: Cnidaria – Class: Anthozoa)

Sea cucumber

(Kingdom Animalia – Phylum: Echinodermata – Class: Holothuroidea)

Seal

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: Carnivora)

Sea Urchin

(Kingdom Animalia – Phylum: Echinodermata – Class: Echinoidea)

Shark

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Chondrichthyes)

Sheep

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: Artiodactyla)

Shrimps

(Kingdom Animalia – Phylum Anthropoda – Class Crustacea)

Sloth

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: Edentata)

Slug

(Kingdom Animalia – Phylum: Mollusca – Class: Gastropoda)

Snakes

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: Reptilia)

Spider

(Kingdom Animalia – Phylum: Anthropoda – Class: Arachnida)

Spirogyra

(Kingdom Plantae – Phylum: Chlorophyta)

Sponge

(Kingdom Animalia – Phylum: Porifera)

Squid

(Kingdom Animalia – Phylum: Mollusca – Class: Cephalopoda)

Squirrel → Chipmunk**Starfish**

(Kingdom Animalia – Phylum: Echinodermata – Class: Asteroids)

Stingray

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Chondrichthyes)

Swallow

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: Aves (birds))

Letter (T)**Tape worms**

(Kingdom Animalia – Phylum: Platyhelmenthes – Class: Cestoda)

Tiger

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: Carnivora)

Toads → Frogs**Tortoise**

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: Amphibia)

Trypanosome

(Kingdom Protista – Phylum: Protozoan – Class: Flagellata)

Turtle

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: Amphibia)

Letter (V)

Vougheir

(Kingdom Plantae – Phylum: Tracheophyta – Class: Ferns)

Vultures

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: Aves (birds))

Letter (W)

Whales

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: Cetacea)

Wheat

(Kingdom Plantae – Phylum Tracheophyta – class: Angiosperma – Subclass: Monocotyledon)

Whiptail stingray → Stingray

Wolf

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: Carnivora)

Letter (Y)

Yeast

(Kingdom Fungi – Phylum: Ascomycota)

Letter (Z)

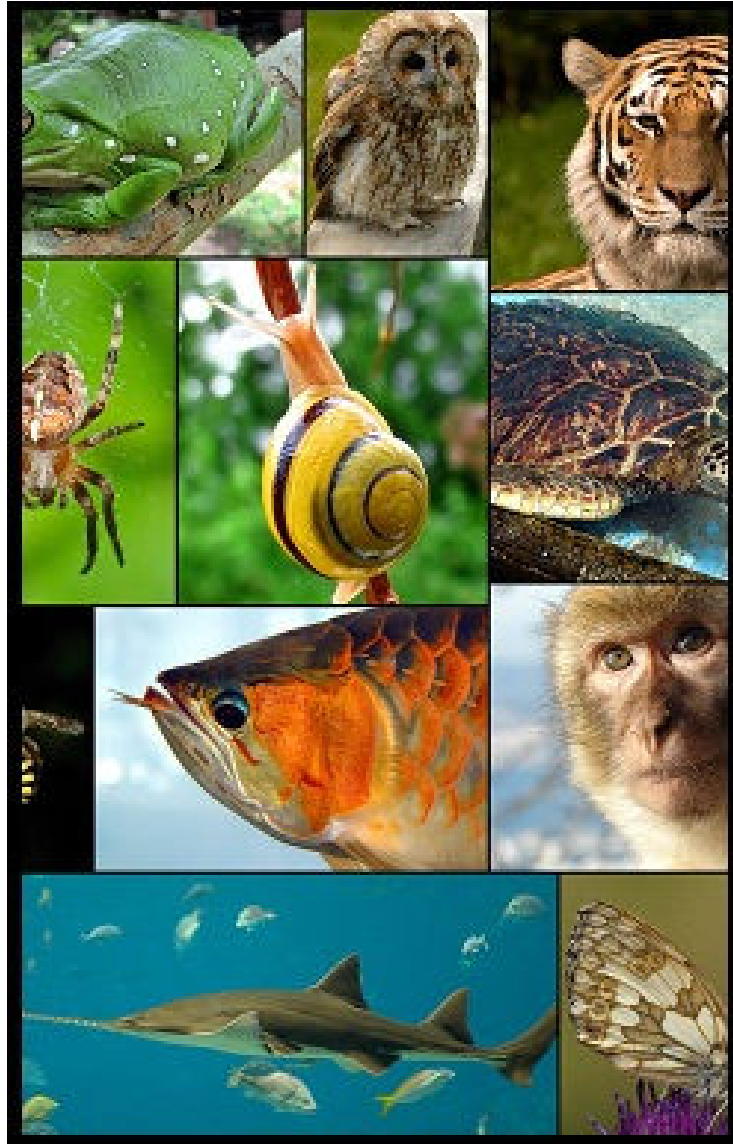
Zebra

(Kingdom Animalia – Phylum Chordata – subphylum vertebrata – class: Mammalia – subclass: Eutheria – Order: Perissodactyla)

Chapter (5) Biological Evolution

Lesson (1)

Origin of living organisms and mechanisms of their evolution



The origin of life on earth is still unknown till now, scientists have two opinions about the origin of life

1st opinion: *Organic compounds from which life originated came to the earth from space*

2nd opinion: *Life originated on the earth, the first organisms to appear were bacteria, and the last to appear were humans*

Life Origin Theories

Special creation theory

→ *It states that all different living organisms were created in their present forms and no changes occurred to them over time.*

Spontaneous generation theory

→ *It states that living organisms may be created spontaneously from non living matter, such as the erroneous belief that mice originated from dirty hay*

The theory of universal origin of life

→ *It states that life reached to the earth in the form of bacteria from celestial bodies (meteors, meteorites....etc). Which means that life began from space*

The theory of earth origin of life (the most scientific theory)

→ *It states that life originated from earth due to the chemical reactions between some substances which were common on earth (Methane, Hydrogen, Water, Ammonia, Carbon monoxide), these reactions were very slow and complex*

→ *In 1953, Scientists Urey and Miller succeeded in changing Methane (CH₄), Hydrogen (H₂), Ammonia (NH₃), Water (H₂O) and carbon monoxide (CO) into amino acids, the building units of proteins, with the help of high electric charges for long time periods. They received Nobel Prize for this*

Evolution

Evolution: *The gradual and slow change in the characteristics of living organisms over long time periods*

→ *The supporters of evolution theory see that the idea of biological evolution depends on the following points:-*

- 1- Each kind of living organisms originated from more primitive and less structured organism which existed before it*
- 2- Permanent changes occur to the shape, structures and functions of organisms*
- 3- The changes occurring to living organisms are very small, but over centuries they accumulate causing big differences which result in the creation of different Living organisms*

4- The number of living organisms is variant, as all living organisms didn't appear at the same time. But they appeared gradually and evolved till they became in their present forms

Philosophers and the origin of life

Thales: Living organisms originated from water

Alexander: Living organisms originated from mixture of sun and water

Aristotle: He believed in the idea of the gradual change from the simple to the complex (from the incomplete to the complete)

Mechanisms of evolution

1- Natural selection

→ British scientist **Charles Darwin** (1809 – 1882) began his historical trip around the world in 1831, which ended in 1836 (after five years). He noticed the differences between the living organisms he found on some islands, especially those on **Galapagos Island**.

→ Darwin noticed that birds have different shapes of beaks due to the adaptation of every species with the kind of food it eats and the evolution of beaks by natural selection

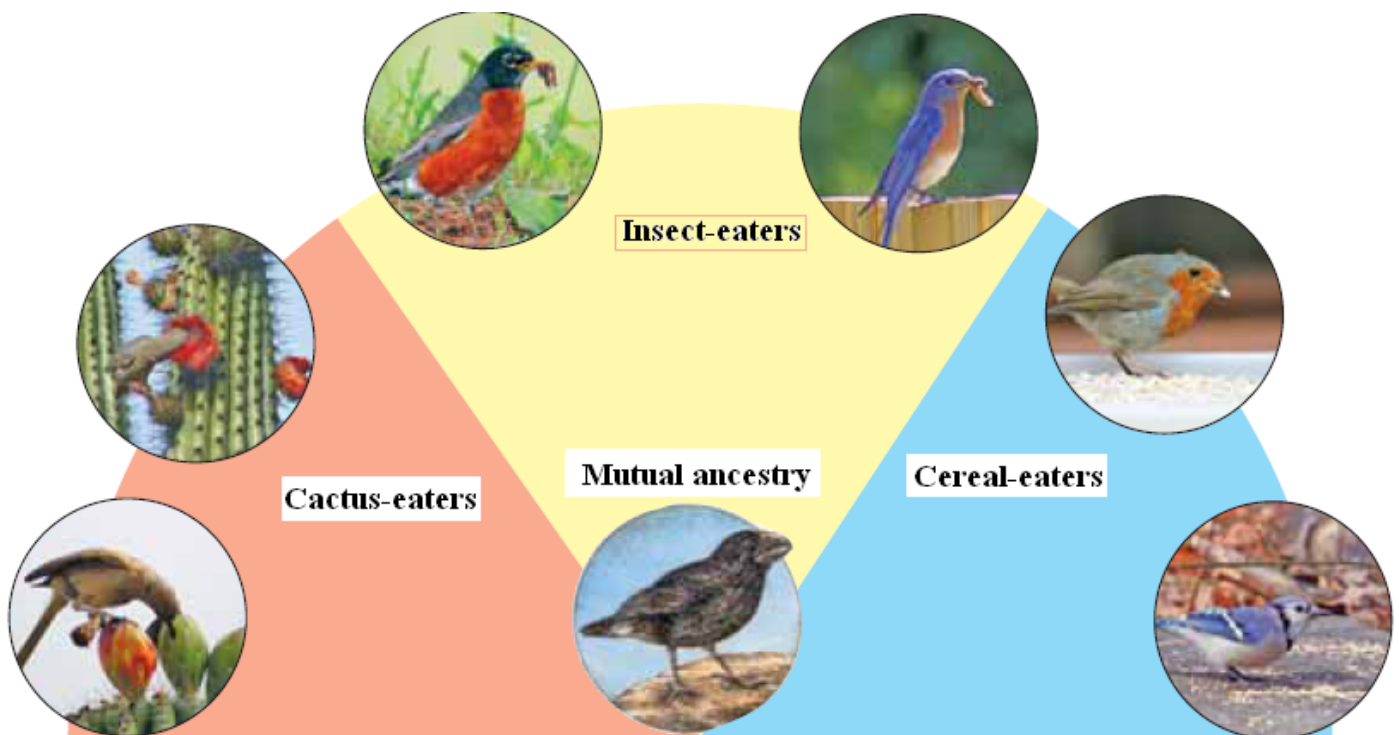
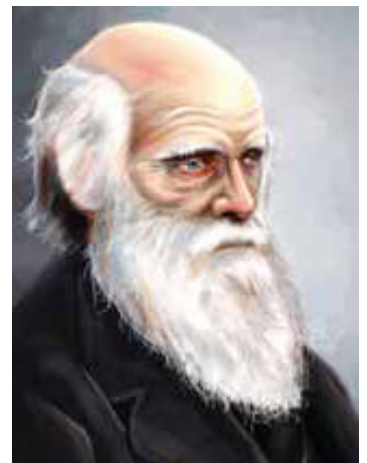


Fig. (1) Natural selection and beaks of birds, each kind has different shape

<u>Bird</u>	<u>Beak shape</u>	<u>Kind of suitable food</u>
Vulture	Hooked	Meat
Duck	Broad and flat	Grass - vegetables
Pigeons	Short and pointed forward	Seeds
Cattle egret	Long	Insects



Fig. (2) Cattle egret



Fig. (3) Pigeon

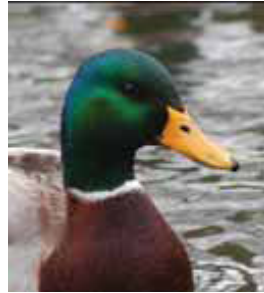


Fig. (4) Duck



Fig. (5) Vulture

Explanation of natural selection

→ Living organisms face extreme conditions which lead to their death. So, weak organisms which cannot face these conditions die. When weak organisms die, their characteristics cannot be inherited at all. On the other hand, strong organisms which could overcome the extreme conditions by their characteristics go on living and give these characteristics to their offspring. Over the time, strong characteristics accumulate forming new organisms.

→ **Sexual selection** works on increasing the occurrence of natural selection, where the stronger and more suitable males and females mate. So, good characteristics are inherited to the offspring. Weak characteristics disappear because living organisms do not tend to mate with weak individuals

Artificial selection

→ Darwin carried out an experiment on pigeons, he concluded that we can increase or limit a certain characteristic in living organisms. We can do so by determining the mating couples

→ Darwin observed that artificial selection gives the same results of natural election, but it needs more time



Fig. (6) Frisian cow race

→ Artificial selection caused the appearance of new animal races such as **Frisian cow**

A shepherd cross different races of animals in order to accumulate the good characteristics of different races together, which produces a new race causing the evolution of living organisms by artificial selection

→ Artificial selection is directed, while natural selection is directed by nothing but nature factors

Natural selection: *Selecting organisms which are most adapted to environmental conditions due to the accumulation of inherited traits, which help them survive and go on living*

2- Struggle between living organisms

→ Struggle between the individuals of the same or different species works on increasing the chances of natural selection occurrence

→ Struggle between living organisms for food and shelter is called environmental selection, while the struggle for mating is called sexual selection

3- Mutation

Mutation: *Sudden change in the hereditary material of a living organism which causes the change of hereditary trait*

→ Most evolution scientists see that natural selection is not enough for the occurrence of evolution, sometimes mutations work on changing the hereditary traits, which causes the appearance of new traits.

→ Mutation may be positive or negative. Mutations cause the occurrence of genetic variation required for the occurrence of evolution

→ Mutations which occur to some kinds of microbes, which increase their resistance to antibiotics, is an example on mutations causing evolutionary change

→ Mutations cause the creation of new genetically modified organisms. Natural Selection selects the best of these mutations and works on its survival and continuity and eliminates harmful mutations. In other words, natural selection 'sieves' living organisms which carry these mutations

4- Population genetics

→ Population is a group of living organisms of a certain species living in a certain place which inbreed randomly

→ The genes of a population individuals represent the genetic content of the population.

→ We can calculate the rate of genes distribution in the genetic content of the population by counting the number of phenotypes of a certain trait, and determining the kind of gene (recessive – dominant)

→ Scientists **Hardy** and **Weinberg** stated that there is a tendency for the rate of gene distribution to remain constant in a population from one generation to another. The same tendency applies to the phenotypes and genotypes of this genes. In other words, there is a tendency towards a state of genetic equilibrium in the population, that keeps its existence and keeps its genetic characteristics constant

Hardy- Weinberg law: The rate of gene distribution remains constant in a population from one generation to another and the same applies to the genotypes and phenotypes of this gene

Conditions that keep the genetic equilibrium in the population:-

- 1- The population must be large in size so that all genetic characteristics are represented
- 2- All the population individuals should be of the same species
- 3- Mating between individuals should be random, so that mating won't be in favour of a certain characteristic
- 4- Genetic characteristics should not be subjected to natural selection, which increases or decreases its spread in population according to the environment
- 5- Individuals of other populations should not migrate to the population and vice versa
- 6- Mutations should not occur
- 7- Parents of each species should produce equal number of offspring

If one of the previous conditions is not fulfilled, the genetic equilibrium will be disturbed and go in a new direction called **genetic drift**. Which leads to the evolution of population

Genetic drift: Evolution which occurs to the population due to the occurrence of disorder in one or more conditions of genetic equilibrium

5- Variation

Variation of genetic characteristics helps in the adaptation with different environmental conditions, and its continuity.

Causes of variation

- 1- **Sexual reproduction:** It occurs by genetically-different gametes
- 2- The abundance of genetic characteristics of the individuals of same species
- 3- **Genes interaction:** Which makes genes affect each other

- 4- The occurrence of crossing over during Meiotic cell division which works on the variation of gametes
- 5- The influence of different environmental conditions on the appearance of some genetic characteristics
- 6- The occurrence of chromosomal or genetic mutations

7- Adaptation

Adaptation: The compatibility of any structure inside an organism's body to its function

Living organisms have genetic characteristics which make able to be adapted to the environment they live in and helps in continuity and reproduction

Examples: Gills in fish – Wings in birds

8- Isolation and the creation of new living organisms species

→ Scientists see that the formation of new species of living organisms depends on isolating them from their group, and preventing them from mating with individuals of the population. Which is known as **Reproductive Isolation**

→ Reproductive isolation causes disorder in genetic equilibrium and the occurrence of genetic drift; which leads to the appearance of new species

Causes of reproductive isolation

Geographical isolation which occurs due to the existence of geographical barriers (Mountains, seas...etc), which prevents the mating of individuals of the same species

9- Extinction of small groups

Extinction: The gradual decrease of the individuals of a certain species, which leads to its disappearance

Causes of extinction

1- The struggle of species for limited resources , which is called **competitive exclusion**, which makes a certain species surpass another one causing the extinction of that weak species

2- The occurrence of climate changes which are harmful to living organisms, such as drought which causes the extinction of many plants. So, animals which feed on these plants becomes extinct or endangered

3- The struggle of new species with original species

4- The collision of celestial bodies with earth (it is one of the assumptions which explained the extinction of huge reptiles like dinosaurs 62 million years ago)

5- Human activities such as overcutting of trees, overhunting of animals, dehydration of water surfaces and environmental pollution

The effect of extinction of biological equilibrium

Extinction causes disorder in ecosystem, as the constancy of biological equilibrium of any ecosystem is linked to the diversity of the species living in it. When the number of species decreases, the equilibrium decreases and vice versa

Definitions of lesson (1)

Evolution: The gradual and slow change in the characteristics of living organisms over long time periods

Natural selection: Selecting organisms which are most adapted to environmental conditions due to the accumulation of inherited traits, which help them survive and go on living.

Mutation: Sudden change in the hereditary material which causes the change of hereditary trait

Hardy- Weinberg law: The rate of gene distribution remains constant in a population from one generation to another and the same is applied to the genotypes and phenotypes of this gene

Genetic drift: Evolution which occurs to the population due to the occurrence of disorder in one or more conditions of genetic equilibrium

Adaptation: The compatibility of any structure inside an organism's body to its function

Extinction: The gradual decrease of the individuals of a certain species, which leads to its disappearance

Give reasons for

1- Urey and Miller experiment made scientists support the theory of earth origin of life

Because Urey and Miller could change ammonia, carbon monoxide, water and hydrogen into amino acids (the building units of proteins) with help of high electric charges. This experiment supported earth origin of life theory (which states that life originated from the reaction of substances on earth with each other over long time)

2- Birds have different beak shapes

Due to the adaptation of every species with the kind of food it eats, and the evolution of beaks by natural selection

3- Artificial selection is different from natural selection

Because artificial selection is directed, while natural selection is directed by nothing but nature factor

4- Sexual selection is different from environmental selection

Because sexual selection is the struggle of species for mating, while environmental selection is the struggle of species for food and shelter

5- Mutations play an important role in biological evolution

Because they cause changes in hereditary material, which causes the appearance of new hereditary traits and hence evolution

6- The type of antibiotics used for treatment should be changed every certain period of time

Because mutations occur to microbes which increases their resistance to antibiotics, so we should change the type of antibiotic so that the microbes could not resist it.

6- The occurrence of genetic drift

Due to the occurrence of disorder in one or more conditions of genetic equilibrium

7- The variation of living organisms

Due to:-

- 1- Sexual reproduction: It occurs by genetically-different gametes*
- 2- The abundance of genetic characteristics of the individuals of same species*
- 3- Genes interaction: Which makes genes affect each other*
- 4- The occurrence of crossing over during Meiotic cell division which works on the variation of gametes*
- 5- The influence of different environmental conditions on the appearance of some genetic characteristics*
- 6- The occurrence of chromosomal or genetic mutations*

8- The extinction of some living organisms

- The struggle of species for limited resources*
- 2- The occurrence of climate changes which are harmful to living organisms*
- 3- The struggle of new species with original species*

4- The collision of celestial bodies with earth (it is one of the assumptions which explained the extinction of huge reptiles like dinosaurs 62 million years ago)

5- Human activities such as overcutting of trees, overhunting of animals, dehydration of water surfaces and environmental pollution

9- The sudden disappearance of dinosaurs

Because a celestial body hit the earth 62 million years ago, which lead to the change of climate conditions and hence the extinction of dinosaurs

10- Competitive exclusion is from the major causes of extinction

Because the struggle between species for survival makes a certain species surpass another one, causing the extinction of that weak species

What happens when

1- The immigration of living organisms carrying certain characteristics to another population

This causes disorder in the genetic equilibrium of the population, which causes the occurrence of genetic drift and hence evolution

2- The occurrence of climate changes which are harmful to living organisms

This will cause the extinction of these organisms, or make them endangered

3- The occurrence of geographical isolation between the individuals of the same species

This will prevent individuals of the same species from mating. So, they tend to mate with other animals causing the formation of new organisms with different traits (evolution)

Questions

1- Choose the correct answer

1- The theory which states that life originated due to the occurrence of chemical reactions between some substances is

- A- Special creation theory B- Spontaneous generation theory
C- The universal origin of life D- Earth origin of life

2- Urey and Miller changed hydrogen, water, methane and ammonia into.....

- A- Monosaccharides B- Disaccharides C- Amino acids D- Lipids

3- Microbe acquire the ability to resist antibiotics due to the occurrence of

- A- Isolation B- Mutation C- Evolution D- Adaptation

4- Beaks of Galapagos birds evolved due to

A- Mutations B- sexual selection C- Environmental selection D- isolation

5- Which one of the following conditions aren't from genetic equilibrium conditions?

A- Individuals of population should not migrate

B- Mating should be random

C- The occurrence of mutations

D- The size of population should be large

2- Write short notes about

1- Spontaneous generation theory

2- Mutation

3- Hardy- Weinberg law

3- Compare between

1- Universal origin of life and earth origin of life theories

2- Sexual and environmental selections

Answers

1- Choose the correct answer

1- Earth origin of life

2- Amino acids

3- Mutations

4- Natural selection

5- The occurrence of mutations

2- Write short notes about

1- This theory states that living organisms may be created spontaneously from non living matter, such as the erroneous belief that mice originated from dirty hay

2- Mutation is the sudden change in the hereditary material which causes the change of hereditary traits of living organisms. It sometimes causes evolution

3- This law states that rate of gene distribution remains constant in a population from one generation to another and the same is applied to the genotypes and phenotypes of this gene.

3- Compare between

<i>Universal origin of life theory</i>	<i>Earth origin of life theory</i>
<i>- Life reached to the earth in the form of bacteria from celestial bodies (meteors, meteorites....etc). Which means that life began from space</i>	<i>Life originated from earth due to very slow and complex chemical reactions between some substances which were common on earth</i>

<i>Sexual selection</i>	<i>Environmental election</i>
<i>- It is the struggle of living organisms for food and shelter</i>	<i>- It is the struggle of living organisms for mating</i>

Lesson (2)
Evidences of the occurrence of evolution



Evidences of evolution occurrence: Fossils – Taxonomy – Comparative anatomy – Vestigial structures – Physiological resemblance – Stages of fetal growth – Molecular biology

1- Fossils

Fossils: The remains or traces of living organisms which lived in old ages and were buried after their death in sedimentary rocks

Conditions for fossil formation

- 1- The presence of hard skeletons for living organisms
- 2- Burial of living organisms in sedimentary rocks right after their death
- 3- The presence of suitable mineral medium which replaces the organic parts of living organisms



Fig. (7) Fossils

Fossils prove the existence of its living organisms in the past, but fossils of some organisms were not formed because of factors which prevented the occurrence of petrification process which are:-

- Lack of water in porous layers of sedimentary rocks, which causes the decay of living organism
- The occurrence of volcanoes and earthquakes, which causes the deformation and breakage of fossils

Index fossil

Index fossil: Fossil of living organisms on which we depend in the comparison between the layers of sedimentary rocks in order to determine their relative ages

Index fossil is fossil of living organisms species which lived for a short period of time of geological history of earth and disappeared, this species had a wide geographical spread and lived in many environment.

Importance of fossil study

- 1- Determination of the geological age of rocks by determining the age of fossils in them
- 2- Recognizing the landmarks of old environment
- 3- Proving the evolution of living organisms
- 4- Comparing between rocks layers by index fossils
- 5- Drawing old geographical maps: as fossils gave us information about the distribution of water and land in the past

Examples of fossils:-

Original remains of living organisms

→ Fossils may be of a whole organism such as Mammoth fossil. Mammoth is a species of elephants which lived 20,000 years ago in south Europe.

→ Fossils may be of bones or teeth of an organism which died and buried, their soft tissues decayed and their hard parts remained (Ex. Teeth and bones of dinosaurs)



Fig. (8) Fossil of dinosaur bones



Fig. (9) Fossil of mammoth

Petrified remains

→ Such as the petrified forests in Mokattam hills, where silica (silicon dioxide SiO_2) replaced the fibres of trees keeping their original shapes.



Fig. (10) Petrified tree

Moulds, casts and printings

Mould: Fossil which carries the internal details of the solid skeleton of living organism after its death. (Ex. Ammonite fossil in sedimentary rocks)

Cast: Fossil which an organism leaves after its death, which decays in soft rocks (Ex. Cast of tree leaves – Fish bones on rocks)

Printing: The shape which an organism leaves on soft rocks in its life. (Ex. Printings of dinosaurs feet on rocks)



Fig. (11) Ammonite fossil
Mould



Fig. (12) Dinosaur feet
Printing



Fig. (13) Fish fossil
Cast

Fossil Record

Fossil record: Complete set of fossils which records the evolution of some living organisms during geological ages, such as fossil records of horses and elephants

Fossil record of horse

→ Fossil record of horse illustrates that the first ancestries of horse were small-sized and their forelimbs ended with four fingers and a printing of fifth finger, and their hind-limbs ended with three fingers and printing of fourth finger

→ They evolved over time and their size increased, their limbs had three fingers, the middle finger is the longest of them

→ Evolution went on and limbs ended with one finger with two small fingers (which do not touch the ground) on both of its sides



Fig. (14) Evolution of horse

Intermediate fossil

Intermediate fossil: Fossil which has the characteristics of two consecutive classes

Example: Archaeopteryx fossil (intermediate link between birds and reptiles)

→ Archaeopteryx fossil has many characteristics of birds, such as the existence of feather, wings and beaks

→ Archaeopteryx fossil has also some characteristics of reptiles, such as the existence of teeth in the beak, bony vertebrae in tail and claws in wings



Fig. (15) Archaeopteryx

2- Taxonomy

→ We studied in last chapter that living organisms are ordered in phyla from the simple to complex organisms. Development is graduated from one phylum to another. We can say that the arrangement of living organisms is like a tree, which begins from the simple to complex. This lead to the discovery of gaps in living organisms arrangement

→ Scientists closed these gaps by putting some extinct organisms (intermediate fossils) and modern organisms in the living organisms arrangement, such as:-

Archaeopteryx: Closed the gap between reptiles and birds

Lung fish: Closed the gap between fish and Amphibia, as lung fish breathe in water by gills, and breath in case of drought by a structure resembling simple lungs

Cladogram (Evolution tree)

→ It describes the relation between different species and groups of living organisms

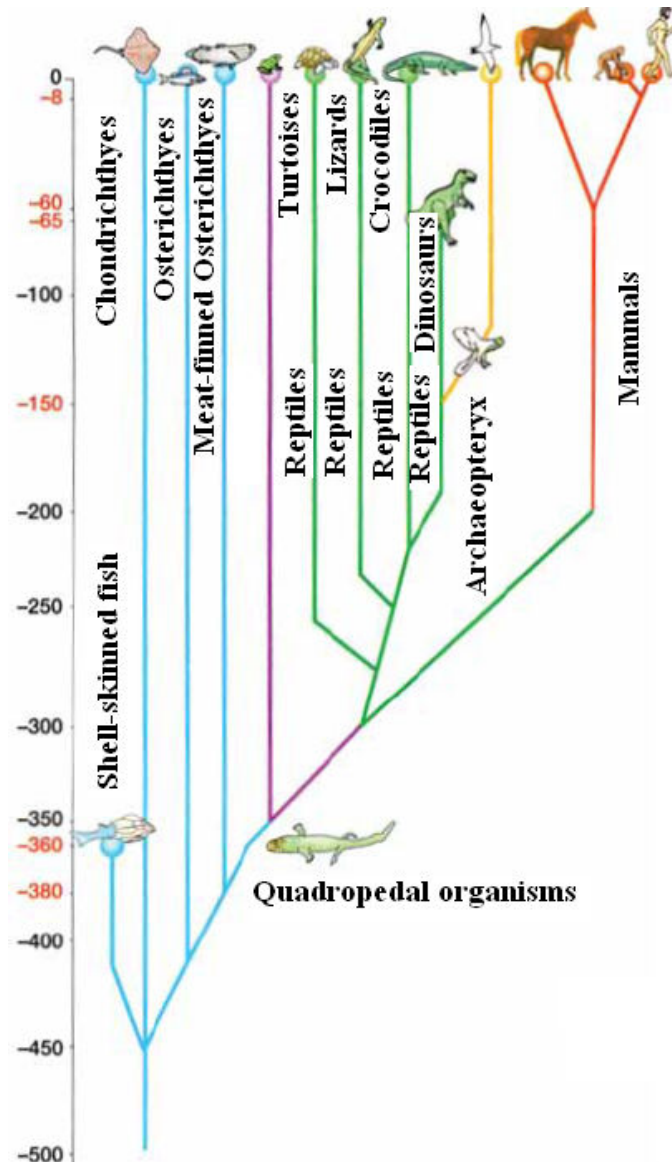


Fig. (16) Evolution tree of vertebrates

From the previous Cladogram we conclude that:-

- The ancestry of living organisms (Quadropedal organisms) appeared 360 million years ago

- All the groups of the Cladogram have vertebral column

→ Cladogram summarizes the relation between species and consecutive groups, beginning from mutual ancestries. It allows us determine the degree of similarity between different species

3- Comparative anatomy

There are similarities and differences between living organisms, which are used in classification. Animals are classified into vertebrates and invertebrates according to the presence of vertebral column

→ Vertebrates are similar in the existence of skull containing the brain, and the existence of blood cells carrying hemoglobin

→ Limbs of vertebrates are similar in structure, but they have different shapes to suit the function

The similarity in vertebrates structure proved that they are descended from common origin

4- Vestigial structures

The proof on the evolution of vertebrates from common origin is that there are organs which used to perform necessary functions in old ancestries. When they became useless, they disappeared or diminished.

Examples of vestigial structures:-

1- Appendix: A part of large intestine which secretes enzymes to digest cellulose in plants. So, it doesn't exist in carnivorous animals (lions), it is large in herbivorous (rabbits) and diminished in human, it is thought that it was large in old human who used to eat plants

2- Muscles that move ears: large in most mammals (Ex. dogs – horses) and diminished in human

3- Coccyx vertebrae: They are vertebrae with which vertebral column ends, they form the tails of lot of animals. They are diminished in human

4- Third eyelid (nictitating membrane): A transparent membrane which appears obviously in the eyes of birds and reptiles to protect them from sands carried by the wind. This eyelid is diminished in mammals and doesn't exist in humans



5- Physiological Resemblance

Living organisms are similar in many vital functions, such as:-

1- Cytoplasm: All living organisms cells have protoplasm in which anabolism and catabolism processes takes place in an identical manner

2- Cell division: Cell division occurs in the same steps in all living organisms under the control of nucleus (which carries hereditary material identically in the form of chromosomes)

3- Wastes: Living organisms are similar in excreting wastes in the form of nitrogenous compounds, but the kind of compound differs according to the kind of animal:-

- Fish get rid of nitrogenous wastes in the form of ammonia through gills, because it dissolves in water quickly

- Amphibians and mammals get rid of nitrogenous wastes in the form of urea through kidneys, as urea dissolves quickly in urine water

- Reptiles and birds get rid of nitrogenous waste in the form of uric acid with faeces, because uric acid is insoluble in water

4- Hormones: Vertebrates are similar in the existence of glands responsible for regulating vital processes in body (Digestion, growth, reproduction...etc)

6- Stages of fetal growth

→ All organisms which reproduce sexually begin their life as a single cell called zygote

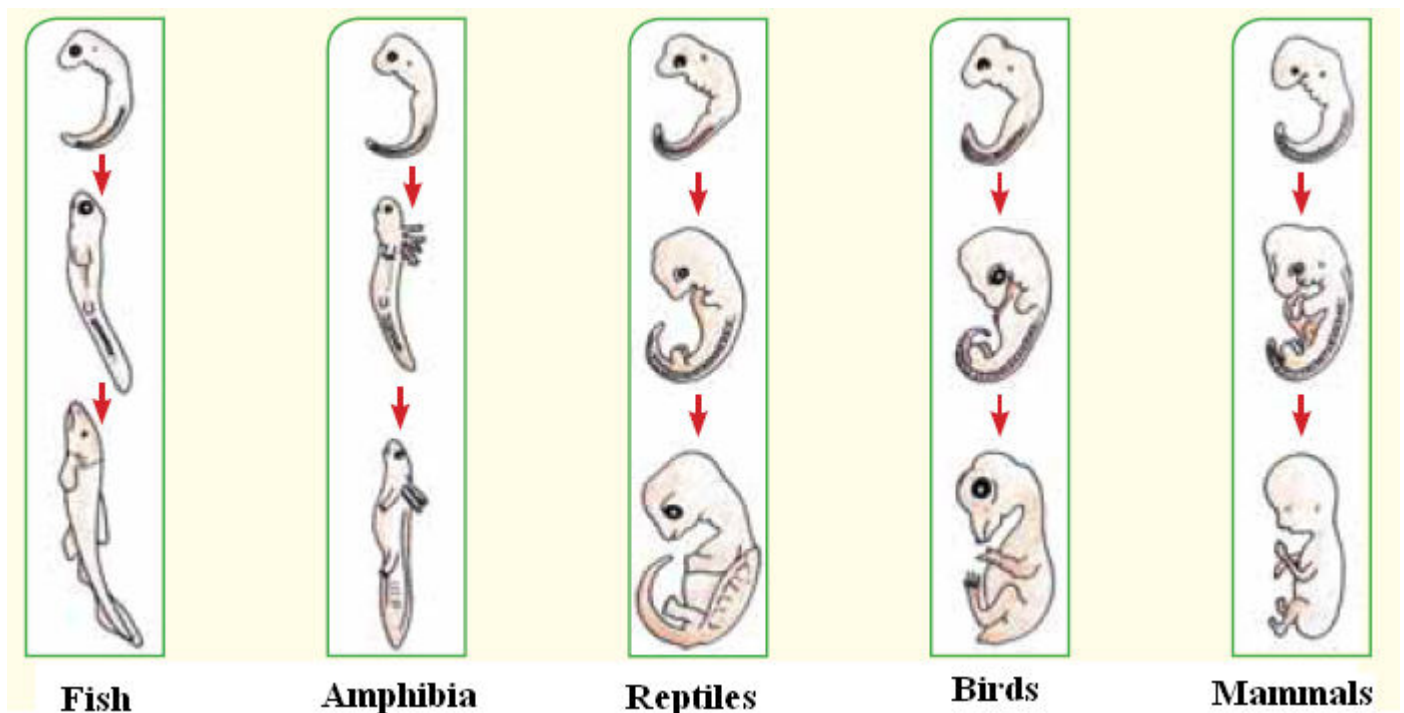


Fig. (17) Stages of fetal growth in vertebrates

→ The fetuses of the previous vertebrates pass through the same stage, where gill slits are formed, and heart is formed from two chambers (one auricle and one ventricle). As growth goes on, changes begin to appear

→ Fetal similarity in mammals proved that they are descended from common origin

→ Bird fetus gets rid of nitrogenous wastes in the 1st stage (inside the egg) in the form of ammonia (like fish). Then, it begins getting rid of these wastes in the form of urea (like Amphibia). When growth is over, it gets rid of these wastes in the form of uric acid

7- Molecular Biology

Molecular biology science is from the modern evidences of evolution theory, as hereditary material in all living organisms is composed of the same building units (nucleotides). Which proved that all organisms are descended from a common ancestry.

Science, technology and society

A- Natural reserves (protectorates)

Natural reserve: An area of nature preserving particular types of plants and animals which is surrounded by a barrier to be protected from environmental conditions and human activities

Importance of natural reserves:-

- 1- They protect the endangered species from extinction
- 2- They protect natural resources and biological diversity
- 3- They keep the environmental balance constant
- 4- They can be used in touristic purposes

Natural reserves in the Arabic Republic of Egypt

→ There are 30 natural reserves in Egypt

In South Sinai:-

- Ras Muhammad protectorate
- Tiran and Sanafir Islands
- Saint Catherine protectorate
- Abu Galum protectorate
- Napq protectorate

In North Sinai:-

- Zaranik protectorate

In Red Sea governorate:-

- Gebel Elba

In Matrouh governorate:-

- Alameed protectorate

In Portsaid governorate:-

- Ashtoum El Gamil protectorate

- Tennis island

In Aswan governorate:-

- Wadi Al-Alaqui protectorate

In fayoum governorate:-

- Wadi Elrayan protectorate

- Lake Moeris

B- Determination of fossils age

→ Age of fossil are determined by measuring the ratio of radioactive carbon in it. The first to use this technique was the American chemist Willard Libby in 1949. He calculated the age of organic substances (Hair, bones, plants, wood, natural textiles...etc) approximately

How to determine the age using radioactive carbon

→ Radioactive carbon is the radioactive isotope of carbon (carbon-12)

→ When cosmic radiation reaches the atmosphere everyday, it causes the reaction of carbon-12 and carbon-14 with oxygen forming carbon dioxide gas.

→ Plants absorb both carbon-12 and carbon-14 during photosynthesis process

→ The ratios of carbon-12 and carbon-14 are equal to those in the atmosphere in this time.

→ When living organisms die, the ratio of carbon-12 doesn't change, while the ratio of carbon-14 changes (due to its decay) without being replaced

→ Half time of carbon-14 equals 5730 years. In other words, half the amount of carbon-14 decays to its half after 5730 years

→ So, we can measure the amount of carbon-14 in a petrified tree and that in an alive tree, which gives us its age approximately

Definitions of lesson (2)

Fossils: The remains or traces of living organisms which lived in old ages and were buried after their death in sedimentary rock

Index fossil: Fossil of living organisms on which we depend in the comparison between the layers of sedimentary rocks in order to determine their relative ages

Mould: Fossil which carries the internal details of the solid skeleton of living organism after its death.

Cast: Fossil which an organism leaves after its death, which decays in soft rocks.

Printings: The shape which an organism leaves on soft rocks in its life.

Fossil record: Complete set of fossils which records the evolution of some living organisms during geological ages, such as fossil records of horses and elephants

Intermediate fossil: Fossil which has the characteristics of two consecutive classes

Protectorate: An area of nature preserving particular types of plants and animals which is surrounded by a barrier to be protected from environmental conditions and human activities

Give reasons for

1- The importance of fossils

Because:-

- 1- Determination of the geological age of rocks by determining the age of fossils in them
- 2- Recognizing the landmarks of old environment
- 3- Proving the evolution of living organisms
- 4- Comparing between rocks layers by index fossils
- 5- Drawing old geographical maps

2- The fossils of some animals weren't formed

Because of factors which prevented the occurrence of petrification process which are:-

- Lack of water in porous layers of sedimentary rocks, which causes the decay of living organism
- The occurrence of volcanoes and earthquakes, which causes the deformation and breakage of fossils

3- Archaeopteryx fossils in the intermediate link between birds and reptiles

Because Archaeopteryx fossil has many characteristics of birds, such as the existence of feather, wings and beaks. It has also some characteristics of reptiles, such as the existence of teeth in the beak, bony vertebrae in tail and claws in wings

4- The importance of Cladogram (Evolution tree)

Because it describes the relation between species and consecutive groups, beginning from mutual ancestries. It also allows us determine the degree of similarity between different species

5- The existence of fully-grown appendix in rabbits and such herbivorous animals

Because rabbits feed on plants basically. So, appendix is fully grown in order to secrete enzymes which digest cellulose in these plants

6- Appendix in humans is diminished (from vestigial organs)

Because it was fully-grown in old man who used to feed on plants, but now it became useless in human, so it diminished

7- Birds and reptiles have nictitating membrane (third eyelid) in their eyes

To protect their eyes from the sand carried by the wind

8- Mammals forelimbs are modified

In order to be adapted to their environment and functions

9- Molecular biology give an evidence on the validity of evolution theory

Because molecular biology states that hereditary material in all living organisms is composed of the same building units (nucleotides). Which proved that all organisms are descended from a common origin.

10- The importance of protectorates

Because:-

- 1- They protect the endangered species from extinction*
- 2- They protect natural resources and biological diversity*
- 3- They keep the environmental balance constant*
- 4- They can be used in touristic purposes*

Questions

1- Choose the correct answer

1-..... is an example on fossils of entire organisms

- A- Ammonite fossil B- Amber C- Mammoth fossil D- Dinosaur bones*

2- is an example of moulds

A- Petrified forest B- Fish fossil C- Ammonite fossil D- Mammoth fossil

3- is an example on casts

A- Petrified forest B- Fish fossil C- Ammonite fossil D- Mammoth fossil

4- is the intermediate link between birds and reptiles

A- Lung fish B- Archaeopteryx C- Dinosaurs D- Shield fish

5- is the intermediate link between fish and amphibians

A- Lung fish B- Archaeopteryx C- Dinosaurs D- Shield fish

6- is an example of vestigial organs in human

A- Appendix B- Duodenum C- Cerebrum D- Uterus

2- Write the scientific term

1- The remains or traces of living organisms which lived in old ages and were buried after their death in sedimentary rock

2- Fossil of living organisms on which we depend in the comparison between the layers of sedimentary rocks in order to determine their relative ages

3- Fossil which carries the internal details of the solid skeleton of living organism after its death.

4- Fossil which an organism leaves after its death, which decays in soft rocks.

5- The shape which an organism leaves on soft rocks in its life.

6- Complete set of fossils which records the evolution of some living organisms during geological ages, such as fossil records of horses and elephants

7- Fossil which has the characteristics of two consecutive classes

8- Area of nature preserving particular types of plants and animals which is surrounded by a barrier to be protected from environmental conditions and human activities

The Answers

1- Choose the correct answer

1- Mammoth fossil 2- Ammonite fish 3- Fish fossil 4- Archaeopteryx

5- Lung fish 6- Appendix

2- Write the scientific term

1- Fossils 2- Index fossil 3- Mould 4- Cast 5- Printing 6- Fossil record

7- Intermediate fossil 8- Protectorate